THE JOURNAL OF THE NATIONAL SMOKE ABATEMENT SOCIETY

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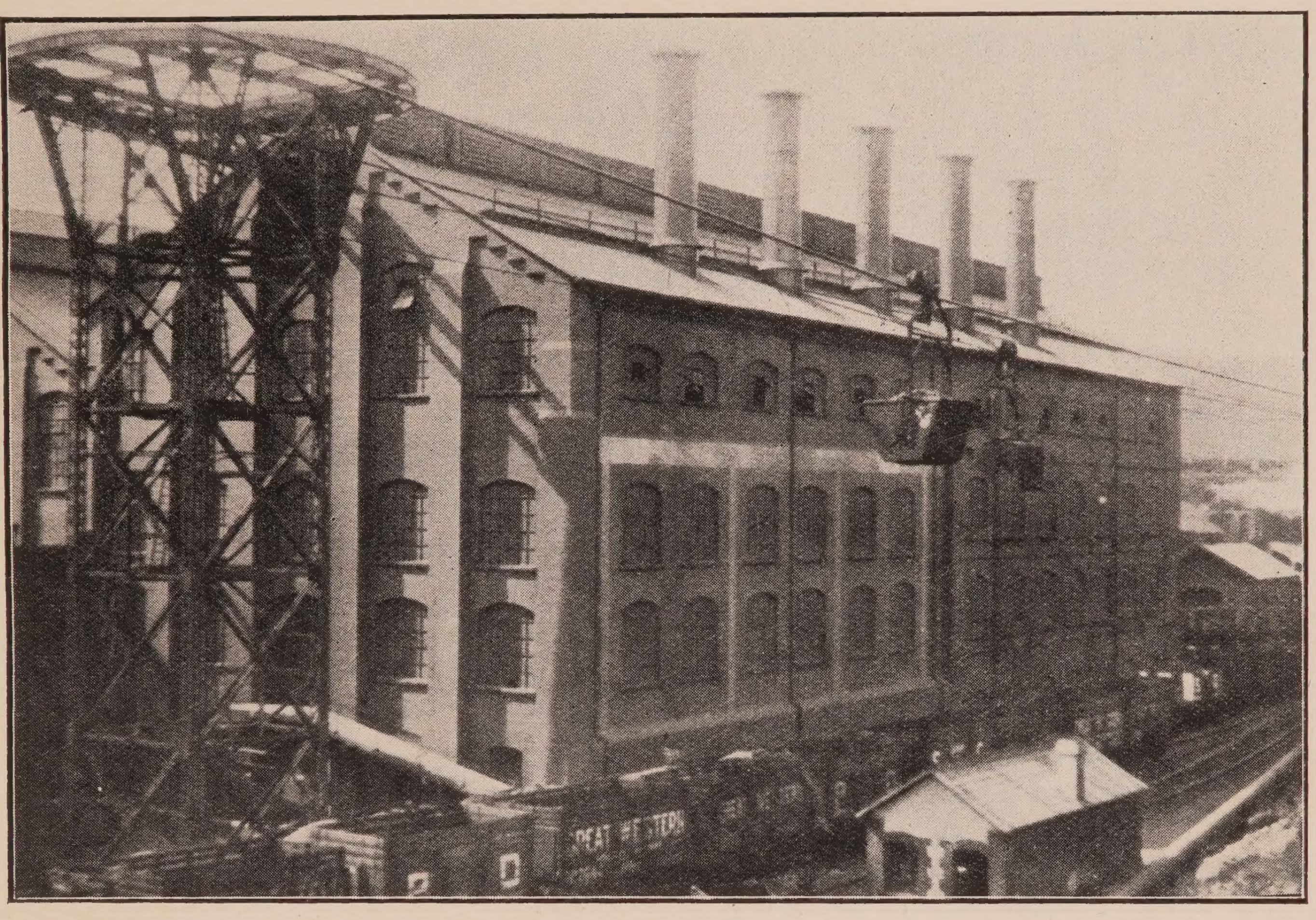

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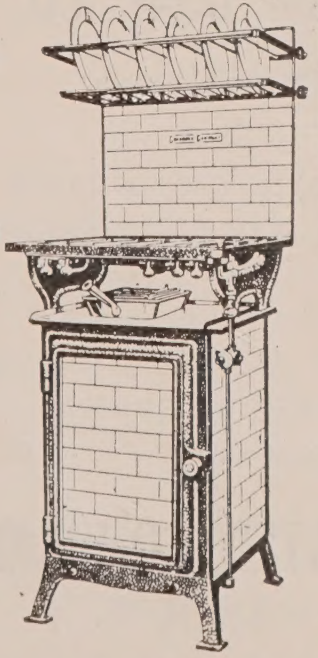

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"CLEAN AIR"

The Official Quarterly Journal of the National Smoke Abatement Society

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CONTENTS OF AUTUMN ISSUE

Page
Commentary 3
Towards Clean Air 13
Domestic Heating 19
Use and Development of Electricity in Industry 27
Current Events 36
Page
Congratulations 7
The Buxton Conference 17
Use and Developmment of Gas in Industry .. 22
From the Municipalities 33

COMMENTARY

A NEW magazine can be produced with a usual statement that it " fills a long felt want " ; with a blare of defiance to the world at large ; or even with a suggestion of an apology. To those of us who are not normally journalists, but who, on the other hand, are always in danger of being swept away in the never-ceasing avalanche of printed matter, the last course is perhaps the nearest to our hearts. Editorially, however, it would be most unwise, and therefore, in spite of a momentary weakness, it is with pride and pleasure that we present Vol. I., No. 1 to its readers. We refuse to be apologetic in adding still one more magazine to the thousands which are poured out from the presses every day, week, month or quarter, for among them all there is not one devoted to the cause for which we exist. A mere handful will graciously acknowledge our existence at infrequent intervals, but to the majority of them the news value of the subject of Clean Air is zero. The magazine will therefore be the mouthpiece of its Society in a way that nothing else can be. With the support and sympathy of our readers and our advertisers, it may well become the most powerful mouthpiece the reform has yet had.

The first number of many magazines is by far the best that is ever produced. We have done what we can with the first number of CLEAN AIR, but because of the short space of time which has been available for its preparation, we admit that it falls considerably short of the standards we have set ourselves. It is hoped to have, in each issue, two informative articles of real value to the work, written by recognised authorities on their subjects, in addition to general articles, news, reports, and, it is hoped, correspondence. We would gladly welcome any suggestions or criticisms on our contents or their arrangement, and, in addition, any items of news which may have escaped the general press. CLEAN AIR is the journal of the Society, and not of the Editorial Committee, and its greatest value will be in forming a link between the many members who have no other method of coming into contact.

Unlike many wealthier societies, we cannot afford to subsidise our journal. It must pay its way or cease to exist. We are therefore in the hands of our readers and our advertisers. The circle of subscribers is not likely to be very large at first, but we appeal to all who wish to give us their support, to bring CLEAN AIR to the notice of their friends, and to induce them to subscribe. We are fortunate in the success of our work being dependent upon the use of smokeless fuels, and some kind of appliance

Easy wiring for Electricity

The illustration shows "Dersingham" a large private residence wired throughout with the Henley Wiring System

THE Cleanest Air will come only in the All-Electric Age. That period may be some way off. But it is drawing nearer every year, and you can help it along by using Electricity to the utmost of your ability.

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for consuming it, and we have thus a special interest to the manufacturers and vendors of such fuels and appliances. They have come splendidly to the support of our venture, but as this support is not altogether sentimental, it behoves us and readers to see that their expectations are not misplaced. We therefore ask our friends, of whom all will be interested in some way in the commodities which are advertised, to show preference to those who are giving material assistance to our movement, and further, to make it clear that it is through this magazine that their interest has been aroused.

The unusual flood of correspondence in the daily press in connection with the " peril of the power station " has been largely abated. It is an encouraging sign to see so much attention paid by the popular papers to a certain aspect of the problems of air pollution, even though it is a case of missing the whole in dealing with the part. The agitation has been concentrated upon the proposed Battersea station, the erection of which seems unlikely to be delayed or stopped. This station is undoubtedly one of particular danger, because of its size, and because of the crowded nature of its surroundings, and the close proximity of so many of the nation's valuable buildings and art galleries. Battersea is not, however, the only danger. Other existing and projected stations of great size must be kept careful watch over, and what remedies are available must be enforced for all. The problem of the removal of the sulphurous gases is admittedly difficult, and the nuisance is altogether very different from the usual smoke nuisances. While many of the smaller stations are still deplorably inefficient, as shown by their production of smoke, the present question is solely one of the removable of the invisible acid gases which are produced in large quantities at the large new stations, where the production of smoke itself should be negligible. No complete solution has yet been described, although considerable interest is attached to the process which is reported to have been developed by Mr. P. J. Robinson, City Electrical Engineer, at Liverpool. Particulars of this are not yet available, but it is stated that the method will eliminate both grit and sulphurous gases by means of grit-catchers and washing processes. We sincerely hope the method will come up to all expectations.

Since the passing of the Public Health (Smoke Abatement) Act of 1926, sixty-six Local Authorities have had bye-laws confirmed under Section 2 of that Act. These have been as follows :—

1927	14
1928	17
1929 (to October)	35

Of the total, 42 have been granted a two minute period, and 24 a three minute period of black smoke emission in the half-hour.

The number of applications made and confirmed up to date is far from satisfactory, especially as a large proportion of these are for small urban and rural districts. Apart from the West Riding of Yorkshire, the authorities of which acted in conjunction (and who have had to be content with a three-minute period), there are included very few towns of importance from the smoke nuisance point of view. Many who have not applied, are, of course, working under the 1875 Act or under private Acts, but it is obvious that considerable progress has yet to be made by many local authorities before the 1926 Act really becomes operative, and it is incumbent upon them to awaken to their responsibilities.

Section 5 of the Act relating to the power to make bye-laws respecting new buildings does not appear to have been acted upon at all. Section 6, which relates to the combination of authorities has led to the formation of Regional Committees in the West Riding, Greater London, Manchester and District and in the Midlands. There is, in addition, the Sheffield and Rotherham Joint Statutory Committee. The activities of these Committees will be reported in each issue of Clean Air.

For the use of lecturers : A revivalist meeting was being held at the street corner. The speaker was growing very passionate, and was depicting in lurid terms the horrors which would come to those who did not repent. He pointed an accusing finger at a little man in the front row. " Do you " he thundered, " want to go to that dark and noisome place, where the air is filled with poison, and where the poor souls who exist there stumble about in the fearful fog and smoke ? Do *you* wish to go to that place ? "

" Aye, I do an' all " was the unexpected reply, " its a gradely place, Manchester ! "

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Electricity–the enemy of smoke

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CONGRATULATIONS

We have received a number of congratulatory messages on the occasion of the formation of the National Smoke Abatement Society, and the inauguration of " Clean Air." Below are printed a selection of these messages.

From the Prime Minister.

I am pleased and interested to hear that those who are interested in the campaign for " Clean Air " are getting together and are strengthening their efforts. The polluted atmosphere of many of our big towns and busy industrial districts is one of the legacies left to us by previous generations. They allowed industrial development to proceed without control and with little thought of ultimate consequences. We are still paying the price. We now know that clean air and sunshine are necessary not only for aesthetic reasons but also for the health of our people. I wish you, therefore, all success in your important work.

Ramsay MacDonald

From the Rt. Hon. David Lloyd George, O.M., P.C., M.P.

I am glad to hear of the progress made by the movement for smoke abatement in this country and I cordially welcome the issue of your journal " Clean Air," as an organ of propaganda and instruction on its behalf. Lack of sunlight and fresh air are among the most serious evils which afflict the poorer populations of our great cities and are potent causes of sickness and mortality and the growth of slum conditions.

Every support should be given to sane and practical measures for preventing the pollution of air in our industrial centres by avoidable smoke and thus lessening the heavy toll levied in our cities on life and health.

(*Signed*) D. LLOYD GEORGE.

From Rt. Hon. Margaret G. Bondfield, M.P., P.C.

I wish your new journal all success. It is impossible to over-emphasise the importance not only of dealing with the nuisance of coal smoke, but of dealing with it promptly and decisively. Its harmful effects were, I believe, recognised as long ago as the time of James I., but in spite of that, it has taken something like three hundred years before there has been any organised attempt to get rid of it. Great Britain, as the most highly industrialised country in the world, ought to lead the world in the cause of smoke abatement ; I wish the housewives of the country would become more active crusaders against this nuisance which adds so much to their daily struggles for cleanliness.

MARGARET G. BONDFIELD.

From the Archbishop of York.

I am very glad to hear of the forthcoming Quarterly Periodical, " Clean Air." The Smoke evil is much more serious than is commonly assumed. It is not merely a nuisance in the sense of an inconvenience. It is a source of real injury to health and happiness. I wish all success to the Society engaged in the effort so to stimulate public opinion as to secure that action is taken. The possibility has been abundantly proved in other countries no more fortunately placed than ourselves.

William Ebor:

From the Lord Mayor of London.

I am pleased to note that an important step has been taken recently in your long campaign for cleaner air, in the union of the Smoke Abatement League of Great Britain and our more familiar Coal Smoke Abatement Society, which has done so much to improve the atmosphere of London. The union should do much to effect the great improvements which still remain to be accomplished.

The publication of a journal is an encouraging sign, and should be invaluable to those who are working for your ideals in every part of the land.

From both a national and a metropolitan point of view I wish you success. In particular I wish you success for the sake of London's citizens, and also for her incomparable treasures and buildings, for which she is really the custodian of the nation.

KYNASTON STUDD.

From the Lord Provost of Edinburgh.

I glady avail myself of the invitation to send a message for publication in the Journal " Clean Air " on the occasion of the amalgamation of the Smoke Abatement League and the Coal Smoke Abatement Society of London, and in doing so I would like to take the opportunity of expressing my cordial appreciation of the valuable services carried out by the Associations in their efforts to promote the purification of the atmosphere of our Cities.

Everyone recognises that smoke is not only responsible for causing and aggravating disease and depreciating property, but that if it could be eliminated or reduced there would be a big saving of expenditure on repairs and cleaning as well as a substantial decrease in mortality, particularly in the large cities.

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The "Meldrum" System utilises a closed Ashpit under positive pressure so that the admission of secondary air is not dependent upon Chimney pull but is produced **under the Firebed** and its effect is instantaneous and quite independent of atmospheric conditions. In the case of

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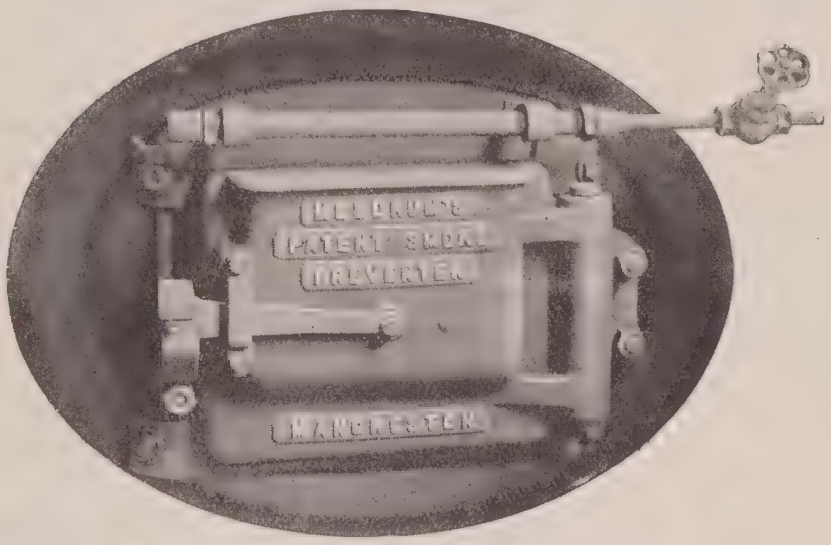

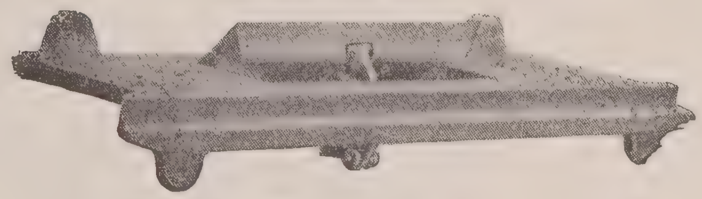

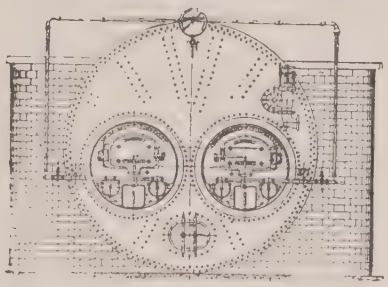

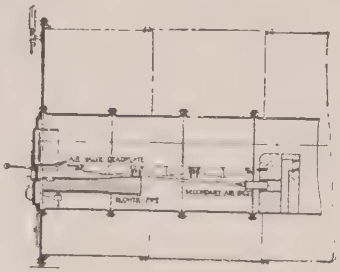

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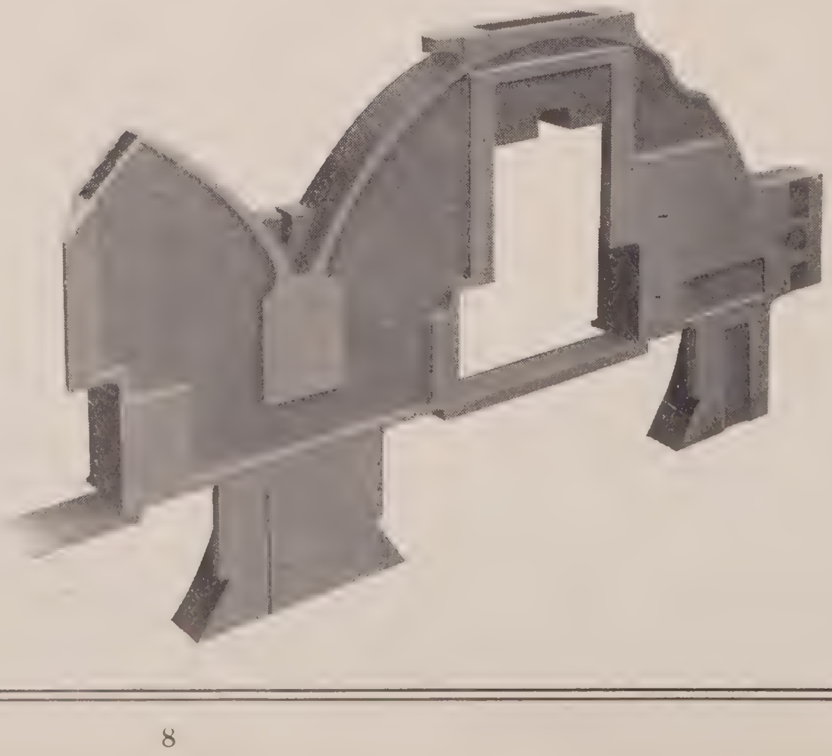
For Watertube Boilers :—Similar features to the last mentioned are used, with the addition of extra air blowers over the firedoors according to duty required and kind of fuel.

Mechanical Stokers :—As bottom view shows a double or hollow Stoker front is used —air is forced down and through this and comes out into the flue—controlled by wheel valves.



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Pure air is quite as essential to the health of a community as pure food and water, and I sincerely trust that the progress which you have made in the past will be maintained in the future, and that its important activities will continue to confer increasingly beneficial results on the community.

ALEX. STEVENSON.

From the Lord Mayor of Manchester.

I am glad to know that the two leading voluntary bodies interesting themselves in the problems associated with the smoke pollution of our cities have fused their interests and forces so that this most valuable work may be furthered.

The damage done to health and property by smoke has for many years been widely known to those specially interested in architecture and preventive medicine, but there is still a great need for the enlightenment of the mass of the people so that the full weight of public opinion may make itself felt behind the demand for the purification of our air.

The difficulties of finding such a solution—both for industrial smoke and for domestic smoke—are very great. It is clear that the desire to abolish the injury which is thus done both to health and property, however laudable that desire may be, must not be allowed to inflict crippling conditions upon our national prosperity. An adequate solution can only be found by the joint effort of fuel chemists, engineers, industrialists and medical men, and it is to such an Association as yours that we look for the impetus which in the end it is hoped will bring together all those various groups of workers in the common effort to abolish one of the greatest plagues which afflicts town dwellers.

With that object in view the National Smoke Abatement Society merits all the public support possible, and on behalf of the City of Manchester, a centre of your efforts, as well as a great industrial centre, I write to offer you my best wishes for the successful prosecution of your work and the early attainment of your aims.

G. WESTCOTT.

From the Lord Mayor of Birmingham.

I am interested to know that through the medium of a quarterly journal the National Smoke Abatement Society are proposing to enlist the sympathy and informed co-operation of as wide a public as possible in the direction of a cleaner atmosphere.

To the lover of health, the lover of natural beauty, or the more prosaic lover of a clean door step and window, the importance of such educational work is too obvious to call for comment. To the industrialist the appeal to the heart can be made with all the greater confidence in that it can be accompanied by an appeal to the pocket.

I cannot do other than wish success to a venture which should make for clearer and sunnier skies and an atmosphere sweeter and cleaner to breathe.

W. BYNG KENRICK.

From the Lord Mayor of Leeds.

CLEAN AIR

I wish success to the National Smoke Abatement Society in the effort that is being made by the inauguration of the quarterly journal entitled " Clean Air " to assist in obtaining a solution of the difficult problem of smoke.

All who are engaged in the public life of our country would like to do something to solve the difficult problem of smoke and any effort in this direction will have the warm commendation and approval of those interested in the welfare of our land.

D. B. FOSTER.

From the Lord Mayor of Newcastle-upon-Tyne.

In my opinion you are dealing with one of the most urgent problems at present before Urban Districts, and every avenue should be explored to seek for a reduction in the harmful effect of a smoke-laden atmosphere. Newcastle is endeavouring to co-operate with other authorities in the district, and co-operation in this direction should be extended in every possible way.

From Lord Provost of Dundee.

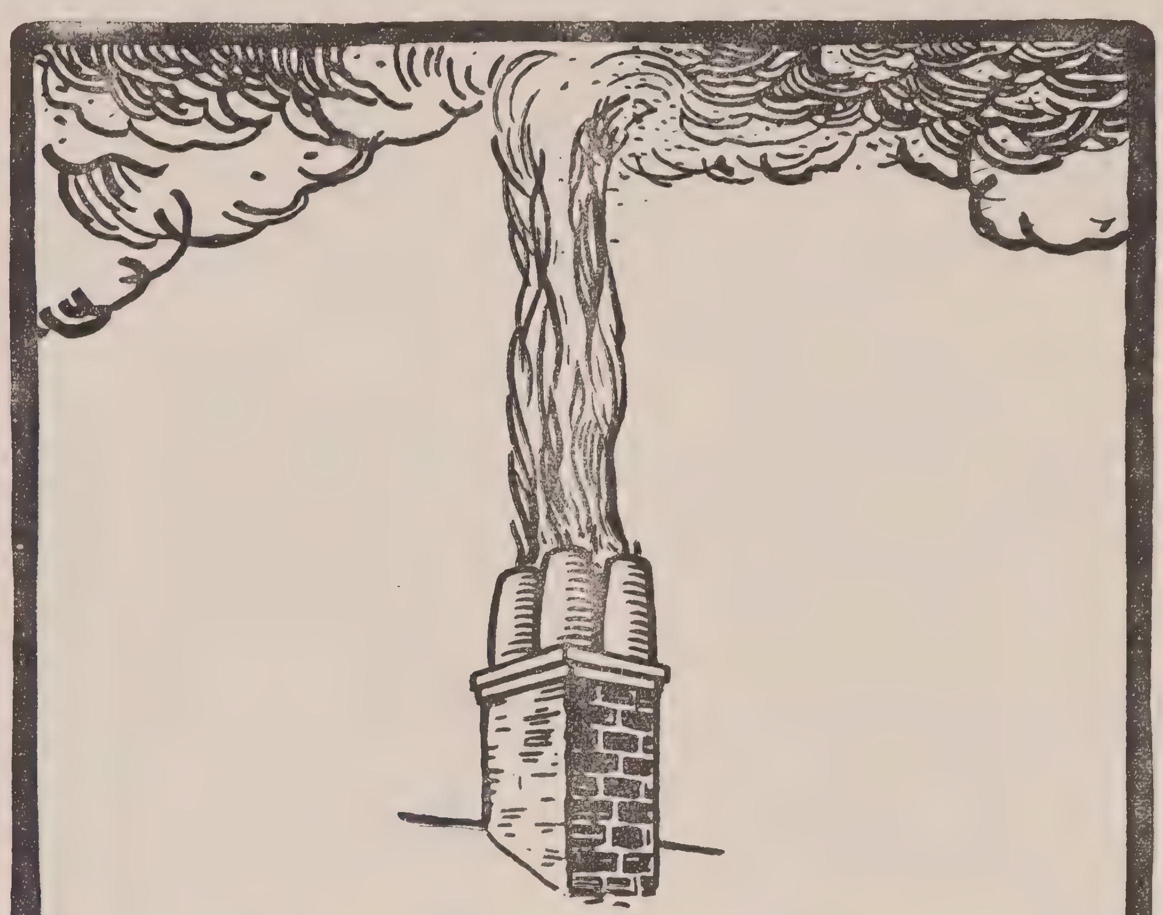
The history of Smoke Nuisance during the last 100 years proves that there have always been a few persons possessed of a clear conception of the enormity of the evil, and who have resolutely set themselves the task of bringing about its abolition.

I rejoice to remember that the Corporation of Dundee was the first Local Authority to introduce into Municipal Housing Schemes central heating systems, having in view the great advantages which were to be obtained for the benefit of the householders, and in addition the outstanding benefits from a local and public health standpoint of an *Unpolluted Atmosphere*.

There is a French proverb which asserts that " too much zeal spoils everything," and while admitting we need zeal to combat the apathy towards smoke abatement which is all too prevalent, I am firmly of the opinion that to get anywhere it must be zeal illuminated with knowledge.

The best of good wishes for your new publication " Clean Air."

WILLIAM HIGH.



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FOR A CURE— Visit the

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COMPLIMENTARY TICKETS may be obtained at YOUR GAS OFFICE

USE GAS AND DOMESTIC COKE

THE IDEAL SMOKELESS FUELS

From the Lord Mayor of Bristol.

We in Bristol heartily sympathise with any effort made to reduce the ill-effects of too much coal smoke, although here the nuisance of smoke is small in comparison with that of the Northern Cities.

The Corporation have in fact just passed a byelaw adopting as a standard three minutes aggregate black smoke within half-an-hour, that is to say, three minutes black smoke in the aggregate within half-an-hour will legally be presumed to be a nuisance unless evidence is established to the contrary.

I sincerely hope that " Clean Air " will prove to be a very successful medium of education of public opinion, and that in a very short time the Smoke Abatement Society will have accomplished its object.

W. H. EYLES.

From the Lord Mayor of Kingston-upon-Hull.

I have much pleasure in commending any movement which will help to ensure cleanliness of the air. The three essential raw products of the body are food, drink and air : we rightly pay great attention to the first two, but have always neglected the third : perhaps we do not value it because it is free. In Hull, records have been taken for many years of the amount of soot deposited in various parts of the City, the centre being twice or three times as bad as the suburbs. We also record the amount of ultra-violet light which reaches the City : very few industrial towns do this, so we cannot compare our figures with those of many similar areas, but we certainly do not receive as many of these beneficent rays as we would like.

BENNO PEARLMAN.

From Sir Napier Shaw, D.Sc., F.R.S.

Now that the study of Atmospheric Pollution has a quarterly journal of its own it may claim its independence as a new science : these lines are to express the wish that it may speedily be successful in making good its title as well as that of its journal.

Like its sister science Meteorology, it depends upon many-sided co-operation. The most important side is now the application of the information about polluted air, which is or can be, available to secure clean air. That is in a special degree the work to which the National Society will address itself with the hearty good will of all those who believe that clean air is not only possible but also in the widest sense profitable.

NAPIER SHAW.

From Em. Prof. J. B. Cohen, Ph.D., D.Sc., F.R.S.

Every new form of public activity, as it spreads in ever widening circles, demands sooner or later a vehicle for publicly expressing itself. The appearance of " Clean Air " is significant of the growing desire to improve our smoke-laden atmosphere.

The waste, the dirt and the stupendous cost which coal smoke entails are being slowly realised. But the problem of air pollution is unike any other, because while it deeply affects the well-being of the community in the same way as adulterated food and contaminated water, no Minister of Health has ventured to deal with its more serious side, namely, domestic smoke. As long as raw coal is burnt in the home, we shall suffer from a polluted atmosphere, even if every factory chimney should disappear.

It will therefore be an important part of the propaganda initiated by " Clean Air" to explain to the householder his responsibility and how he may meet it. Moreover it will be his civic duty to subscribe to the journal. " Clean Air " will also, I hope, press for an ample provision of the cheapest kind of smokeless fuel and steadily advocate its use. That the new journal will serve a most useful purpose I have not the least doubt and its success should therefore be assured.

J. B. COHEN.

¶ Our Journal is newly-born, and is, we think, a lusty youngster. Its growth to full manhood depends on two things, (1) the support of our advertisers and (2) an ever-growing list of subscribers. The responsibility is therefore YOURS. Support the advertisers who are supporting this Journal and see that the names of your friends appear on our Subscription List.

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NOVEMBER 5TH TO 16TH
is proof of this

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Follow the news of the attack on Smoke
by taking the

DAILY DISPATCH

TOWARDS CLEAN AIR

By The Right Hon. Lord Newton, P.C.

IT is one of the ironies of Nature that this country's greatest mineral asset and the source of her industrial greatness should also be the cause of one of her most pernicious and inescapable evils.

The industrialisation of the nation, the use of coal, and the corresponding smoke produced, have all moved forward side by side, whereas the general realisation of the significance of smoke, has lagged far behind.

Smoke, darkness and filth have for long been accepted as the inevitable accompaniments of industry, although at the beginning there seems to have been some revolt against the acceptance of these conditions. Thus the earliest agitation against smoke can be traced back to the fifteenth century, when there existed for a short time a movement which might well be termed the first smoke abatement society.

During the eventful years of the last century the voices of those who sought for a cleaner atmosphere were lost in the rattle and roar of newly-born machinery, and they were looked upon as cranks of the first water. Smoke might not always be pleasant, it was argued, but it did no real harm, and in any case it was an essential and inevitable part of the whole scheme of industry. In fact it may be stated without much exaggeration that half-a-century ago the belief prevailed that wealth and dirt were synonymous and that the dirtier a country the greater was its prosperity.

Even in 1899 when the Coal Smoke Abatement Society came into being, this attitude persisted, and those who worked for it in those days did so rather at the risk of their personal repute. Thus Dr. Des Voeux, who has been elected to the Presidency of the new National Society, has told of how a Lord Mayor of London informed him that they always had a home ready for him at any time—at Dartford, the county asylum !

Now, however, thirty years after, there is a very different spirit abroad. Like all reforms, smoke abatement was at first the fad of the few. To-day it is accepted by the majority of those whose opinion count, as being a serious matter, worthy of consideration and support. To-morrow, it will become the normal matter-of-fact belief of the many.

It is, perhaps, only since the war that this second stage has been reached, and its affects are seen in the growing strength of the movements against smoke, which has recently resulted in a fusion of the two main organisations, and now in the publication of a regular and ambitious magazine.

This satisfactory condition of things has been achieved through the help of a number of different mediums.

Thanks largely to the invaluable statistical and other evidence that has been collected by different workers, and also to the greater interest in such matters by the general public, health authorities and medical associations are now keenly interested in the smoke nuisance, and it is indeed a very backward town or city where there is not some active work by the Health Committee for smoke abatement.

Another valuable factor is the realisation, at long last, that smoke represents merely wasted fuel, and that the production of smoke, apart from its manifold deleterious effects, is a wasteful and uneconomic thing. This has been accentuated by the considerations that have been given to the state of the mining and other coal utilisation concerns, and has been emphasised by the Committee on Smoke and Noxious Vapours Abatement over which I presided, and by the Samuel Commission on the Coal Industry. To-day the terms " smoke abatement " and " fuel economy " are very closely related.

The development of the different methods of smokeless heating has rendered it possible, to an ever increasing degree, to advocate substitutes for raw coal which are only incidentally smokeless, and which possess marked advantages in other respects over the one smoke-producing fuel. Electricity and gas are still developing rapidly and there have been many advances in the preparation of solid smokeless fuels both at high and low temperatures. Appliances for the use of such fuels, and for the use of anthracite and oil, have been greatly improved, with the all-round result that it is becoming increasingly difficult to find excuses for the continued use of coal for domestic, and many industrial purposes.

Finally, the pioneer work of the Coal Smoke Abatement Society and more particularly the indefatigable exertions of Dr. Des Voeux and of Mr. Lawrence Chubb, is now producing its results, and those who are at present actively engaged upon the continuance of the work have the advantage that they are secure upon the foundations laid by these others in the past.

Progress may appear to be slow. The actual amount of smoke eliminated may seem to some to be lamentably small, although it is certain that great, though very gradual improvements have been made, in spite of apathy and opposition. The reform is taking the natural course of its kind, and now seems

Continued on page 21

The Best Way to Reduce Smoke is to Economize Fuel by Insulation

* * *

If half the fuel used for heating dwelling-houses, offices, &c. can be saved, a tremendous step will have been made towards solving the smoke problem.

Ordinary building materials provide very little insulation. For instance 28″ Brickwork in outside walls is only equivalent to 2″ THATCHBOARD.

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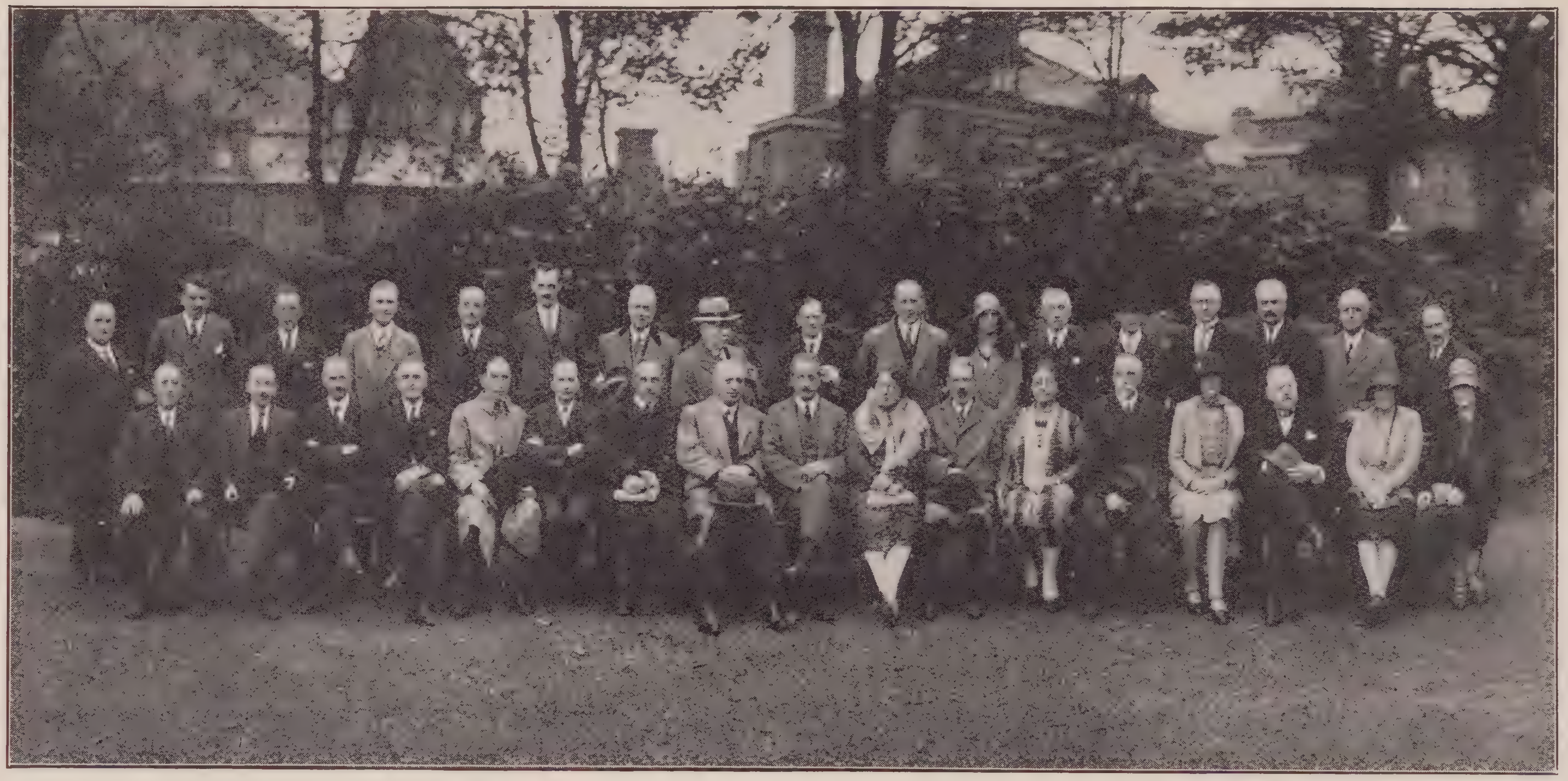
Inaugural Conference of the National Smoke Abatement Society

Held at BUXTON, October 4th to 6th, 1929



Back Row (*left to right*)—E. W. N. Nicol (London), Arnold Marsh (General Secretary), Coun. W. C. Percival (Newcastle-upon-Tyne), W. O. Coates (Buxton), F. Sowerbutts (Sanitary Inspectors' Association), Coun. Smith (Leicester), Allan Stevenson (Hon. Secretary Scottish Branch), Coun. Dorran (Stretford), Dr. E. H. Walker (M.O.H., Stretford), Dr. E. W. Smith (London), Mrs. E. W. Smith (London), Coun. Butterworth (Huddersfield), Coun. Perry (Smethwick), Coun. S. N. Duguid (Lymm), Police-Judge Mackendrick (Clydebank), Police-Judge Abbott (Clydebank), Bailie Munro (Glasgow).

Front Row (*left to right*)—Coun. Timms (Tottenham), Coun. Montague (Tottenham), J. A. Robinson (Bristol), J. W. Beaumont (Halifax), Alderman Adams)Newcastle-upon-Tyne), Coun. Keene (Leicester), Dr. A. A. Mussen (M.O.H., Liverpool), Coun. Hall (Liverpool), Alderman W. Melland (Chairman and Hon. Treasurer), Mrs. W. Melland, Dr. H. A. Des Voeux (President), Mrs. S. L. Jast (Manchester), Ex-bailie W. Brownhill Smith (Glasgow), Mrs. S. N. Duguid (Lymm), Dr. J. R. Ashworth (Rochdale), Mrs. T. Atkinson (London), Miss Cooper (Manchester).

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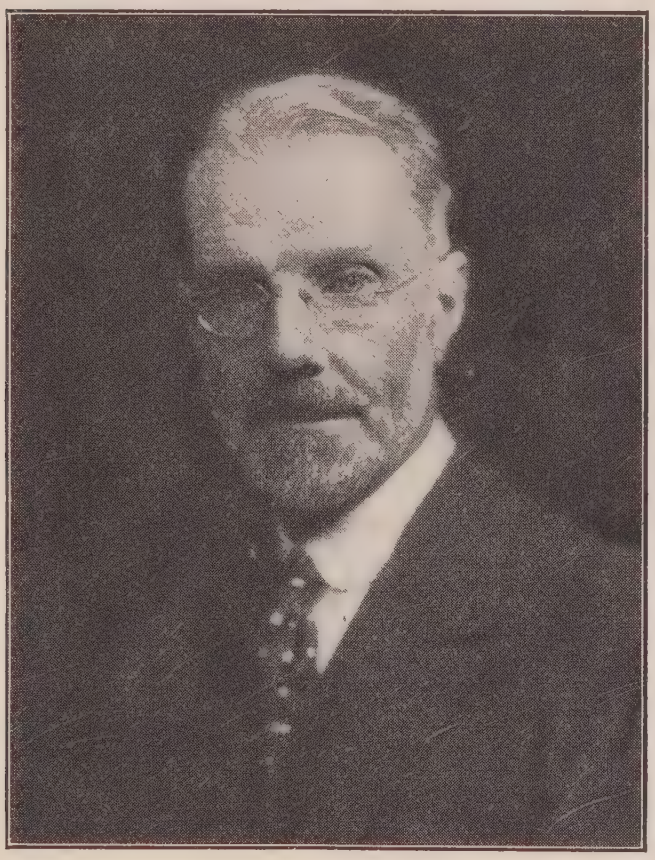
THE BUXTON CONFERENCE

BIRTH OF THE N.S.A.A.

THE Smoke Abatement Conference held in Buxton on October 4th, 5th and 6th, marked the commencement of a new chapter in the history of smoke abatement—a history which one feels should at last be approaching the final volume.

The Conference was held in the Palace Hotel, at which most of the members and delegates, numbering about sixty in all, stayed.



DR. DES VOEUX
Chairman of Smoke Abatement Society

It was probably the busiest series of meetings the movement has had for a long time. Commencing on the Friday evening at 8-30, it did not close until four o'clock on the Sunday. The final Annual Meeting of the Smoke Abatement League of Great Britain was the business of this first session, at which were read the Annual Report and the financial Statement of Accounts. A vote of thanks was accorded to the Hon. Auditors, Messrs. Abbott and Sons.

At ten o'clock on the Saturday morning began the all-important inaugural meeting. On the proposal of Alderman Melland, Dr. Des Voeux, Chairman of the Coal Smoke Abatement Society, took the chair. After a few preliminary remarks the resolution declaring the two organisations amalgamated was read, and was unanimously carried. The meeting then became the first general meeting of the new association. A resolution declaring the name to be "THE NATIONAL SMOKE ABATEMENT SOCIETY" was then approved, after a few other suggestions had been considered. The next item was the election of officers. Dr. Des Voeux was unanimously elected President, and Alderman Melland, Honorary Treasurer, together with the election of a number of Vice-Presidents—combining the lists of the two defunct organisations.

This session was followed immediately by the Conference proper, which was opened by Councillor Pettitt, Mayor of Buxton, who welcomed members and delegates, and wished success to the campaign which was carried on for cleaner skies. Two most valuable and interesting papers were then read, which dealt respectively with the industrial uses and development of gas and of electricity, and of which full details will be found elsewhere. A number of speakers, including J. A. Beaumont (Halifax,) Bailie Munro (Glasgow), Councillor Keene (Leicester), S. Duguid (Lymm), Dr. Mortlock-Brown (London), and W. Ingham (Manchester) took part. Mr. Cutts who contributed the electrical paper, and Mr. James, who read Mr. Tagg's paper summed up their positions, and ably replied to the numerous questions they had been asked.

About fifteen delegates took advantage of their surroundings to venture forth in the afternoon upon a motor-coach tour round the High Peak district, returning in a heavy rainstorm, which did not, however, appreciably dampen their spirits. The weather was both wild and wet during the three days, and did not offer much inducement for members to forsake their business for the fresh air.

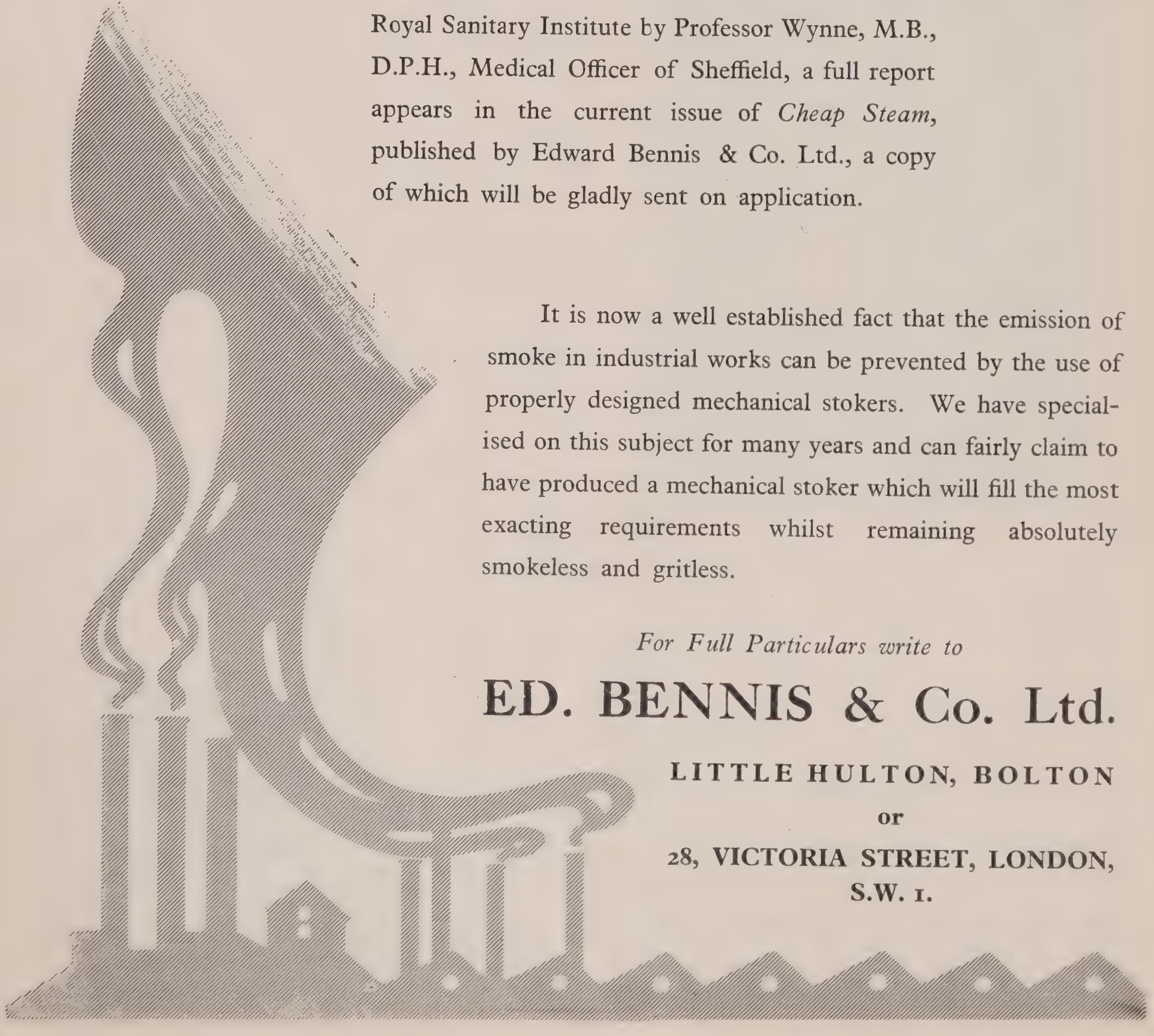
After dinner on the Saturday evening all gathered together in the Conference Room for coffee and informal discussion, which the chief subject of discussion was the place and nature of the next annual conference. London was strongly favoured, and the Executive Committee was recommended to consider this. The claims of Leicester as an ideal place were strongly advanced by Councillor Keene. Leicester and Glasgow, it should be mentioned, were well represented at the Conference, and the proceedings were often enlivened by sallies from one side or the other.

Continued on page 21

Wipe out that smoke !

" Scientific methods of coal consumption would not only abate the nuisance and promote health and the amenity of life, but would be economical in industry. The emission of black smoke from chimneys serving boilers only is unnecessary and reprehensible."

The above is taken from a paper read before the Royal Sanitary Institute by Professor Wynne, M.B., D.P.H., Medical Officer of Sheffield, a full report appears in the current issue of *Cheap Steam*, published by Edward Bennis & Co. Ltd., a copy of which will be gladly sent on application.



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DOMESTIC HEATING

ANNUAL REVIEW

IT is hoped to review annually the progress made by the different types of smokeless fuel used for domestic requirements, and of the methods available for using them. For this first article, however, it will be preferable to give a general sketch of the fuels which can be used domestically, together with their special purposes. The matter may therefore be quite familiar to many readers, although it is surprising to find the amount of misconception which prevails even among the well-informed on smoke abatement generally.

The fuels to be considered are six in number—anthracite, electricity, gas, oil, gas coke, and low temperature carbonisation fuels, and in the home their uses may be classified under three heads, namely, for cooking, water heating, and room warming. These requirements may be carried out separately or, more frequently, in combination with each other.

Cooking may be done alone, as with the gas and electric cooker, or in combination with the hot-water system. The latter is the usual way in the old type of kitchen range, which from the point of view of fuel economy in the home, stands universally condemned. Nevertheless, in such a range, or in a more modern combination, solid smokeless fuels, particularly the low-temperature ones, may be advantageously used. In the old-fashioned range, dependent largely upon a lengthy flame these may not give such a good result as with coal, but in such a case it is fairly certain that the coal is only doing the work wastefully. The combined oven and boiler specially made for the use of gas coke or of anthracite is highly efficient, and gives sufficient hot water to enable partial, or even entire, central heating to be installed.

Hot water may also be obtained by the independent domestic boiler burning either anthracite or coke, for which purpose it is highly efficient. The gas burning geyser is also a useful source of intermittent hot water supply, while the internal heating of the water cylinder can be carried out by a special electric heating device. Room warming may, as indicated, be done by some method of central heating, in a small house by the kitchen boiler or cooker, and in larger houses and in buildings and hotels, etc., by a full central heating apparatus. Those who object to central heating from the point of view of comfort or ventilation, should consider its value as an auxiliary medium. It may thus be used in conjunction with an open fire, gas, or electric fire, while its value in corridors, halls and bathrooms, cannot be overestimated. The panel system is an excellent method of using central heating. In addition to the popular gas fire and electric heater, there is the excellent anthracite closed stove, which possesses the advantages of great heat, high efficiency of fuel consumed and great lasting powers. Special open grates may now be purchased for the burning of either anthracite or coke, and these, in combination with a gas poker for lighting, are very handsome and satisfactory. The ordinary open grate, made for the burning of coal, will frequently give good results with a high-quality gas coke, but it is really saved from ultimate extinction by the coming of the low temperature carbonisation fuels, which will burn suceessfully and brightly on almost any kind of fire. To the many who still prefer the open fire, with flame and variety, these fuels take away the last excuse for the production of domestic smoke. They form, in effect, the last link in the chain of smokeless homes.

The methods of central heating are of great interest, although they do not effect the average householder to any great extent. The systems now available, which will burn coke, anthracite, or oil, are of remarkable quality and dependability, and with the automatic feeds and temperature controls which are now fitted, render the attention they require negligible.

The fuels themselves present many problems to the smoke abatement worker. They each possess special advantages, and often, to the general public, special disadvantages. The question of price is of great importance in popularising their use, and it has to be stressed very forcibly that the initial cost per unit, therm, or ton, is not the only thing to be considered. Working efficiency, cleanliness and convenience are each very important factors, and when reviewed correctly, they appreciably reduce the margin between the price of coal and of the smokeless medium. The reduction in cost for gas and electricity for intermittent purposes must also be borne in mind. The virtues of these two methods of heating are so well-known that they do not require particular emphasis here.

The remarkable efficiency of anthractie is not sufficiently known. It may be stated that it, and the allied anthracitic smokeless coals, are the only ones which it is economically wise to burn in the raw state. Considered simply as a coal, its uniform low ash and moisture content, high calorific value and lasting powers, render it an ideal fuel for many purposes.

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Considerable interest is attached to the carbonisation fuels, prepared at high temperatures by usual gasworks practice, and at low temperatures by various manufacturing processes. The former, which still bears the rather harmful name of coke, has been greatly improved in recent years, mainly due to the use of vertical retorts and in not quenching the hot fuel on discharge from the retorts, in water. The resultant dry, open product has had a very encouraging reception in those areas fortunate to receive it. Much experimental work requires to be done, and some is being done, to perfect still further this fuel, especially from the points of view of ingition and free-burning quality. The kindred low-temperature fuels, which possess a greater percentage of volatile matter, have had a chequered history, but their production is now an accomplished fact. That is, they can be produced commercially with qualities which are highly satisfactory to the consumer, and they are thus to be unhestitatingly recommended. The economic stability of the methods used, and the disposal of the other products of carbonisation are important problems, and upon their solution depends the continued and increasing availability of the solid product. The discussion of this vital point is, however, a separate subject, and for this domestic consumer it is the quality and price of the fuel itself that are the paramount factors.

The use of oil is of considerable interest, especially for central heating purposes, and also for its increasing popularity for general domestic cooking and heating.

An important factor to be borne in mind in connection with domestic heating is the question of heat insulation. The amount of fuel consumed may be appreciably lowered by the use of suitable material for insulating the room. This is, of course, of greater importance in less temperate countries than this, and has occasioned the publication of a special manifesto by the Candian Fuel Board. The question is, nevertheless, of importance to us, and it is hoped to deal with it at greater length in the near future.

In conclusion it may be stated that the policy of the Society is to advocate the use of each smokeless fuel strictly upon its merits. There is a field for each one, in which each will show special advantage over others, and it is impracticable to endeavour to solve the domestic smoke problem without enlisting the aid of every possible medium. Every possibility must be utilised to the full in order to overcome the most difficult obstacle of all—the psychology of the average British housewife.—A.M.

Towards Clean Air—*contd. from page* 13

to be upon the threshold of direct action and eventual accomplishment. It must not, however, be taken that the work is virtually finished, but, on the contrary, it means that a greater intensification of effort must be made; that the support which has been gained must be utilised to the full; that the campaign must be developed in every part of the land; and that every aspect of the question must be driven home with still greater vigour.

The most tangible result of many years agitation is the Smoke Abatement Act passed by the late Government. That measure is doubtless open to criticism, but its success depends entirely upon its administration. In other words local authorities have now the power to deal with the smoke nuisance, and if it is permitted to continue the responsibility will rest upon them.

NEWTON.

The Buxton Conference—*contd. from page* 17

Early next morning a further general meeting of members discussed clause by clause the proposed constitution for the new body, which had been drawn up previously and circulated among those present. This was a heavy and complicated work, but ably guided by the President, all difficulties were finally settled, and what should be a complete and satisfactory constitution was obtained. Then followed the election of the Executive Committee—twenty-three names being submitted and accepted, and finally, after an adjournment for lunch, the election of non-representative members of the Council. The meeting closed finally by re-affirming the support of the new body to the Smoke Abatement Exhibition in Manchester, which is being organised by *The Daily Dispatch* in conjunction with the Society, and by an expression of thanks to the management of the Palace Hotel for the excellent and delightful arrangements made.

USE AND DEVELOPMENT OF GAS IN INDUSTRY

By Samuel Tagg
(Engineer and Manager, Preston Gas Company, Past President, Institution of Gas Engineers).

The following is a paper read at the Inaugural Conference of the Society at Buxton on October 5th. The paper has been somewhat abbreviated for publication.

THE suitability of a fuel for a particular industrial process, depends not only upon its heating value, but on other factors, such as readiness of application and ease of control, to which the late Sir George Beilby applied the convenient term of " availability."

Although solid fuels in the form of coal and coke constitute the cheapest form of heat, gas is used in increasing extent in industry, as it possesses in marked degree the advantages of " availability."

Taken in the literal sense a supply of Town's gas is available in all industrial areas, whereas transport and storage facilities for coal may only be obtainable at considerable cost.

New businesses, along with old, can enjoy the advantage of a gas supply at little or no first cost and can rely upon a continuous service, night and day, throughout the year.

Although industrial disputes have been only too frequent during the post-war period, the gas industry thanks to its mutually satisfactory relations with labour, has avoided internal trouble, and its organisation was sufficiently complete to enable it to maitain practically a full supply during the prolonged coal stoppages of 1921 and 1926.

The introduction within recent years of the method of charging for gas on the therm scale, instead of the volume basis, has led to greater uniformity in the composition, specific gravity, and calorific value of Town's gas.

Uniformity in composition and quality ensures an unvarying flame temperature, and permits of the maintenance of oxidizing or reducing conditions at will, and its importance is well illustrated by one of many applications of gas for the heat treatment of metals, viz. : the annealing of steel.

Steel which has been mechanically worked by rolling, bending or forging, usually results in a product in which there is internal strain, and this defect is cured and the steel rendered suitable for machining by reheating and cooling slowly through certain critical temperatures.

These range from 750 degrees Centigrade to 890 degrees Centigrade depending upon the percentage of carbon in the steel and if the limits of variation exceed 20 degrees to 30 degrees the material under treatment must be scrapped.

It is therefore of vital importance to output to avoid variations in temperature, and the use of gas-heated furnaces with their easy and exact regulation has proved highly successful in the elimination of waste or rejects.

A further example of the importance of the nature of the heat required in an industrial process is that of rivet heating.

Rivets have to be heated up to about 1050 degrees Centigrade before being driven home and it is essential that they be heated quickly and uniformly throughout.

They should further be free from scale, and the furnace should allow of the rivets being put in and taken out without difficulty.

An American shipbuilding firm recently discarded an extensive equipment of coke and oil furnaces, and substituted gas for this purpose after exhaustive study and exacting tests.

Amongst other reasons they adopted gas firing because it meant rapidity of heating, control of temperature by the operation of a single valve, minimised scaling and rivet wastage, better working conditions and higher speed resulting from the elimination of smoke, ashes and excessive heat.

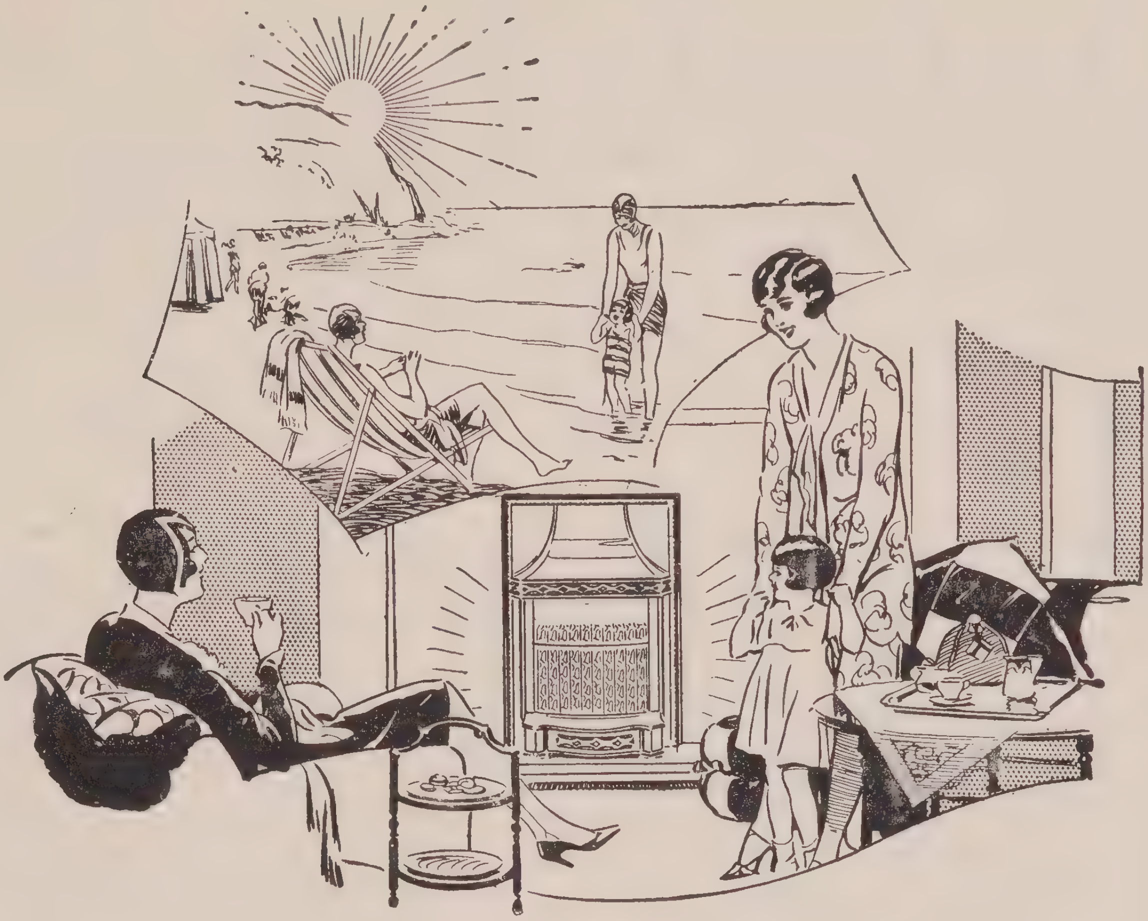
In actual experience it was found that with gas firing the hull rivetters put in 300 to 500 more rivets per day, that a ton of burnt rivets was saved per day. and that only one gas heated rivet was thrown away to every four damaged oil-heated rivets.

In all applications of gas for heating purposes large economies are effected in labour costs, and improved conditions provided for those still employed.

There are many industrial heat requirements which can only be met by the employment of flames, such as the gassing and singeing processes in the textile industry and in glass-making and electric lamp manufacture.

In the former, cotton worsted or silk yarns are drawn rapidly through a small gas flame so quickly that while the flame chars and removes the loose nap it does not burn the main thread but gives the yarn a smooth surface.

In the singeing process the fluff or nap is removed from the surface of the woven fabric which will then bleach and take delicate colours more evenly.



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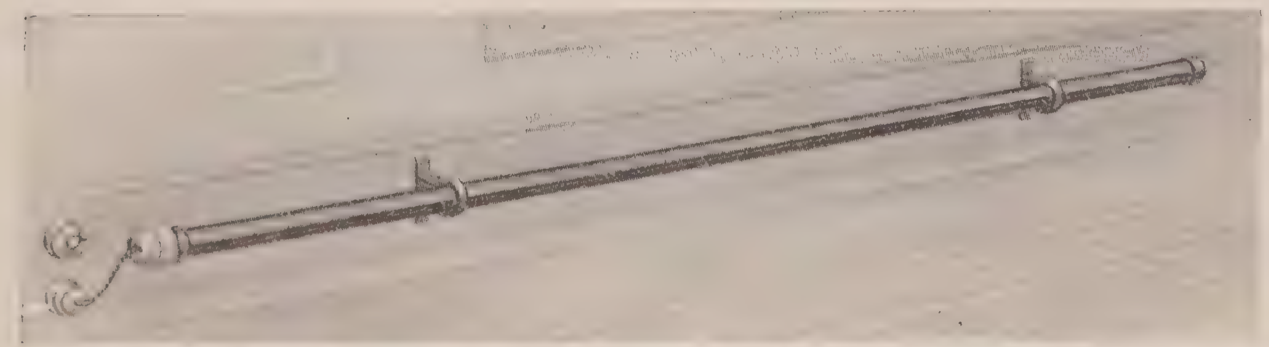

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Innumerable other examples of the specialised service which gas is serving in industry could be given as it is estimated that it is used in over 3,000 trades for an average of seven processes in each.

To recapitulate, heat is a universal necessity in manufacture and coal gas is the most adaptable and efficient means of providing that heat.

By its employment, waste is eliminated, production cheapened, output speeded up, and the working conditions for the human element improved.

In a recent review of the problem Sir Arthur Duckham summarises the position as follows :—

" There are many processes in industry in which gas immediately commends itself as an ideal fuel, First, where the cost of fuel is a minor consideration, while convenience, cleanliness, labour-saving, evenness, and exactitude of temperature, are the factors that count.

" Take next those industries in which the cost of fuel is a more important item, but on which the exactness of application of the heat is of paramount importance. In this category much headway is being made.

" A third class of industries is that in which the cost of fuel is a major item, and the savings to be effected by the use of gas are limited to labour and transport, saving of space for plant and storage, the non-production of smoke, and the recovery of by-products.

" If we roughly divide the industrial users of gas into these three classes then I estimate it would pay the industries to use gas in case one at a price per therm from ten to twenty times that of raw coal per therm. in case two at a price per therm from five to ten times that of coal and in case three at a price per therm from three to six times that of coal. "

Under present conditions there is a wide potential market, as yet undeveloped, for gas for industrial purposes, and with a cheapening of the price this market would be enormously extended.

The Director of the research institute of the Combustion Utilities Corporation of America estimates that the potential market for industrial gas is at present only two per cent. saturated.

The consumption in the Birmingham area for heating and motive power is about ten times greater than in the years immediately prior to the war, the annual output in 1928 reaching nearly 3,800 million cubic feet.

The industrial load in Sheffield is about 2,400 million cubic feet per annum, and it has been estimated by those best qualified to form an opinion, that with a reduction of price of less than one penny per therm it would pay the steel works to use gas to an extent which would increase the industrial load five-fold.

It is stated that there are large numbers of furnaces in use fired by raw coal, in which the thermal efficiency, *i.e.*, that amount of heat transferred from the coal to the material heated, is little over 5 per cent., and only those of a continuous type reach at the best under 25 per cent.

Owing to inadequate facilities for the economic handling of coal, and the large amount of labour required for the coal-fired furnaces, the cost of coal into the fire grate reaches 1.2 pence per therm.

Gas-heated furnaces will give much greater efficiencies as the fuel will be burnt with the correct proportion of air, and without the heavy loss of heat at present carried away in the form of smoke, and a further ecomony is possible through the pre-heating of the air by the waste gases.

Producer gas of low thermal value is used to some extent for gas-fired furnaces in steel works at the present time, but its use is not unattended with difficulties.

If hand operated the producers employ a large amount of labour, and in lagre works more than one plant is required as it is not practical to convey the gas more than 150 yards.

It is also a costly matter to keep the flues or mains free from dust and tar, and the necessity for the temporary cessation of operations seriously hampers production.

The President of the Board of Trade appointed a Committee this year to consider the closer co-operation of the gas and coke oven industries, and the terms of reference include the question of a supply of gas on an economic basis to meet the potential requirements of industry.

These industries each carbonise about 16 million tons of coal per year, and the total quantity so treated approximately equals the consumption of coal for domestic purposes in England and Wales, and represents about twenty per cent. of the total quantity used for all purposes within that area.

Those concerned with the question of smoke abatement will be interested to know that the heat requirements of these industries for the carbonisation processes is entirely supplied by gas.

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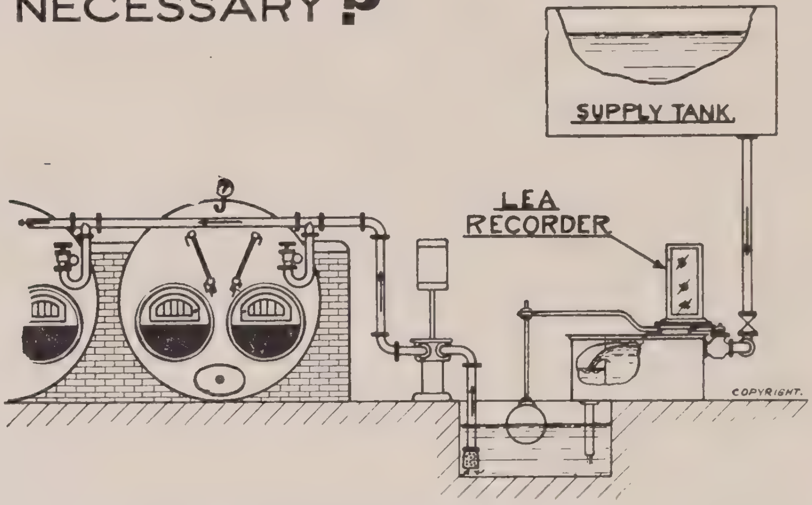

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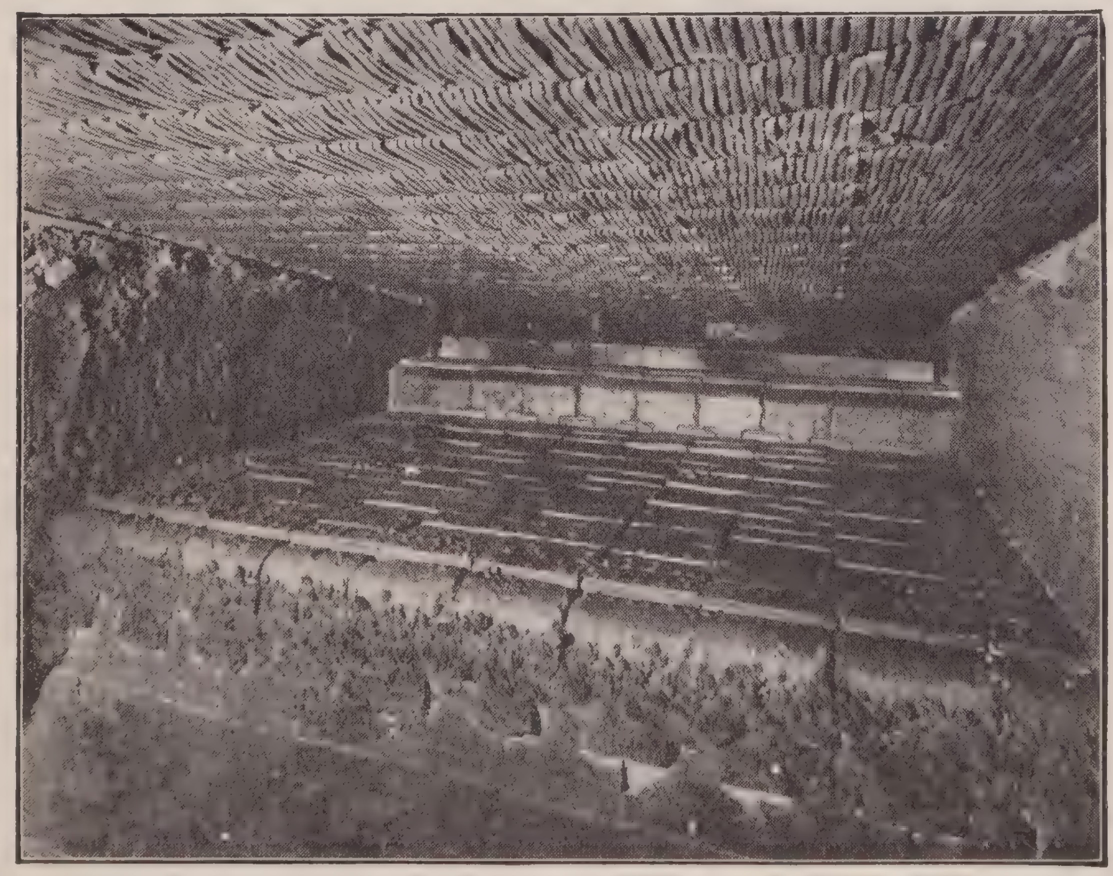

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In modern gas works practice the retorts are heated by producer gas generated from coke, and the sensible heat of the waste gases leaving the retort settings is utilised either for heating the stream of secondary air required for the combustion of the producer gas, or for the generation of steam through the medium of waste heat boilers.

In the most efficient regenerative by-product coke ovens about 40 per cent. of the debenzolised gas produced is required for the purpose of carbonisation, and in those of the combustion type provision is made for the alternative use of low-grade gas, such as blast furnace or producer gas, thus releasing the richer coke oven gas for other applications.

If coal was used for the above purpose instead of gas, over 4 million tons per year would be required, as the internal heat demands of the two industries is five times greater than the heat equivalent of the whole output of electricity by the authorised undertakings in the country.

The coke oven industryi s looking for an assured market for its gas at a price which would justify the expenditure required to modernise its plant. The iron industry is looking for oven coke or more uniform quality which such plant in conjunction with facilities for blending of coal would produce, and the steel industry is looking for a reduction in the cost of iron and for a supply of gas at a price which would enable further economies to be made.

The revival of the iron and steel industries may therefore be said to depend to a considerable extent on the increased use of gas for industrial purposes, and it is very certain that the only solution of the smoke evil lies in the continued development of the great carbonisation industries including the latest recruit, viz.: low temperature carbonisation.

THE USES AND DEVELOPMENT OF ELECTRICITY IN INDUSTRY

By Verdon O. Cutts

A paper read at the Inaugural Conference of the Society at Buxton on October 5th. Mr. Cutts is the electric furnace specialist of the General Electric Company.

To the uninitiated and even to the Engineer and Industrialist of wide experience and interest, the industrial application of electric heat may appear to represent but a small portion of the field covered by the title under which my contribution appears. So far, the developement and application of Electric Heat to Industry has been the work of the enthusiast and pioneer who has rigidly specialised. Consequently, the details and incidents of this development have not been so generally known as would probably have been the case if more people had been engaged in the work. Further, the number of installations has been few in comparison with those for power and general work.

Actually and potentially the subject of electric heat and its application to industry is one of very considerable importance. Industrial electric heating has definitely arrived and no power on earth can arrest its progress. Its field of application is practically unlimited, and in the general industries of the world, it is assuming an ever-growing influence. To-day's tendency towards improved methods and equipment to ensure better production at competitive manufacturing costs, has created a demand for the precision and efficiency which electric heating renders possible. A degree of exactitude which has hitherto been regarded as commercially impracticable is now attainable on a production basis under ordinary shop conditions. Scientific management is facilitated.

Electric heating has a very wide range of application. There are very few industries which do not use heat for some purpose. Furthermore, electric heat can be manipulated and applied so easily and in such varied and convenient ways that there are few purposes to which it cannot be adapted.

In many cases and for many purposes the electric furnace or oven is capable of competing with fuel-fired furnaces on a straight cost basis. Even where this is not possible there is a considerable field in which the value of the inherent advantages of electric heating fully justifies its use. Whilst recognising these favourable facts, it cannot be denied that there are other purposes and circumstances for which and in which electric heating cannot at present compete with fuel-fired furnaces and ovens. In fact, I would go further and state that those of us who are genuinely and permanently interested in the development of industrial electric heating would definitely discourage any projected application which is not certain of success from an economic point of view, even though, technically, it might be quite feasible and practicable.

Smoke and Disease

Smoke is perhaps the gravest danger to our national health.

Statistics show that about fifty per cent. of the time lost in workshops and offices in this country is caused by respiratory diseases due to the pollution of the atmosphere by smoke.

More than half the three-year-olds of this country have rickets, because they are robbed of sunlight by the smoke pall.

The amount of sunlight has been found, by readings taken from various parts of England, to be in inverse proportion to the degree of air pollution.

About seven-eighths of the sun's power is shut off by smoke from the centre of London, and eighty tons of poisonous soot are emitted in the capital every hour.

The remedy lies in the burning of the smokeless fuels, gas and gas coke. The atmosphere is not polluted in the slightest degree either during their manufacture or their actual combustion.

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I will now briefly mention those inherent characteristics of electric heat to which reference has already been made. Electrically, any desired *quantity* of heat may be generated at practically any required *temperature;* this simplifies control. It is a well-known fact that in many cases of fuel-firing, the heat is generated at a higher temperature than that desired, necessitating recourse to a variety of means for mitigating the effect ; this renders precise control more difficult. There are various methods of generating heat electrically and these offer the widest range of temperature. Whilst steep temperature gradients can be obtained electrically and with the greatest ease, it is also possible to work with slight or shallow temperature gradients in an open furnance or oven with exceptionally uniform heat distribution.

Electric heat is subject to precise and positive control. There is a definite relationship between electrical input and heat input, a relationship which is uninfluenced and unaltered by secondary considerations such as, for instance, the admission of a proportionate amount of atmospheric oxygen and fuel. The application of automatic features is facilitated. Thermostatic control is positive, dependable and precise. Any predetermined temperature can be attained and held without appreciable variation for practically any desired time. Previous heat-treatments or programmes which have proved successful may be repeated with precision. The exactitude with which this is done under ordinary shop conditions and without skilled labour is of far-reaching importance and has revolutionised works practice in many instances where repetition work has to be done on a considerable scale.

Labour requirements are cut to a minimum and even dispensed with in some cases.

It has, of course, been amply proved and fully demonstrated that with electrically heated equipment it is possible under ordinary work operating conditions to obtain and ensure exceptional uniformity of temperature throughout the whole furance and charge.

My next point will appeal to you to-day in an especial sense, since we are met in the interests of smoke abatement. Electrically, you have a clean incandescent heat, unaccompanied by smoke, fumes, products of combustion, etc., An electric furnace or oven can be installed in the ideal and most convenient possition, without having to consider that position in relation to the location of existing flues, chimney stacks, etc. Electric heating equipment can be fitted into the machine line or line of production with ease and impunity.

Invariably, less space is required for electric furnaces, etc., than for fuel-fired furnaces.

Owing to the nature of the heat and the conditions under which it is generated, refractories last longer nad upkeep costs are kept low. There is a total absence of scorifying flame, etc.

Dependence upon outside supplies of the fuel is eliminated and the space, plant, apparatus and labour necessary for storing, handling and feeding fuel is saved. Fuel handling often involves dust, grime and heavy physical work. Whereas fuel may vary in calorific value, electrical energy is unvarying in this respect.

The atmosphere of an electric furnace is susceptible to adjustment according to the purpose for which the furnace, oven or appliance is used. An oxidising atmosphere is obtained with ease and bright annealing can be done with equal facility. Special atmospheres as required for special purposes or necessitated to facilitate desired chemical reactions can be obtained and maintained with such ease and certainty as to render electric heating particularly suitable in such circumstances. Electric heat may also be applied in vacuo. All these factors make for an improved and uniform product.

I confidently affirm that the electric furnace and oven represents an important contribution to the subject of smoke abatement. That it is smokeless, I do not suppose any will doubt. No manufacturer can afford to adopt or instal any plant, apparatus or device in the interests of smoke-abatement, unless it is thoroughly practical and suitable for operation under ordinary shop conditions, and independent of special supervision and skill above that ordinarily required. Furthermore, in these hard times the manufacturer rightly requires to see at least return on his money. If, however, we can put before him a means of co-operating with us in the laudable object of smoke abatement, which also offers definite advantages such as improved product, or actual saving in working costs, in addition to improved operating conditions, he will be much more ready to become a champion of smoke abatement and benefactor to those whom he employs, and to those who reside in the vicinity of his works.

We will first look at a few applications in connection with the Steel Industry. The first application of electric heating to this industry was for melting and making steel. Now the use of electric melting furnaces in the steel industry is confined almost exclusively to the melting of scrap, the refining of Bessemer or open hearth steel and production of special alloy steels.

The most important field for the electric furnace in this industry from the point of view of this meeting is that of heat-treatment. Probably no branch of metallurgy has advanced so rapidly as the heat-treatment of

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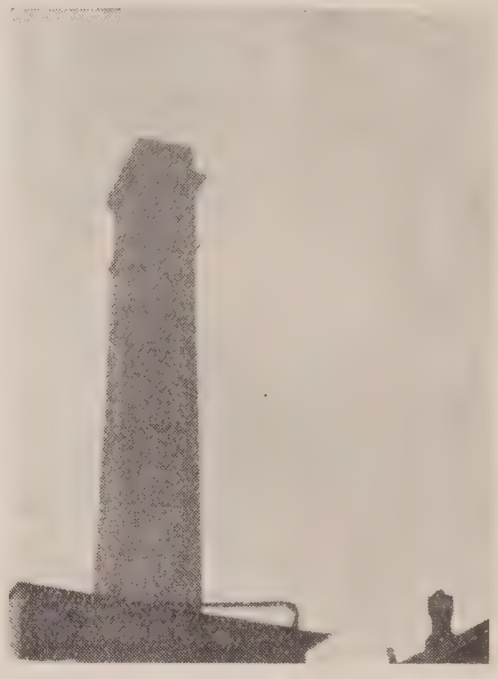

WITH SEOTOO

1881 In 1881 the Committee of the Smoke Abatement Exhibition awarded Mr. Dowson a Special Prize, given by the late Sir William Siemens, F.R.S., for "The best method or arrangement for utilising fuel as a heating agent for domestic and industrial purposes combining the utmost economy with freedom from smoke and noxious vapours."

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steel. Whereas a few years ago it was a mystery carried on by a few in a secretive way—and then in an approximate and crude rule-of-thumb manner—now it is a precise science of almost universal application. The electric furnace is asserting itself for this work because it is vital that the temperatures to which steel is heated should be determined with the greatest possible precision that is consistent with works practice and shop conditions. Especially is this true of alloy steels. Failing this, an otherwise good steel may be completely ruined for the purpose for which it is intended.

In recent years metallurgical science has advanced to such an extent as to enable the production of steels especially suitable for almost any conceivable purpose and special duty. It has also introduced the necessity for much more precise heat-treatment than was required when fewer steels of more general application were used. In annealing, for instance, there is an ideal temperature for each steel and the best results are obtained by annealing at that temperature. Heat-treatment specifications are much more rigid and many of them are impossible of achievement except in furnaces capable of working to within a few degrees of a specified temperature and which are also capable of applying heat at that temperature with absolute uniformity throughout. The electric furnace enables this to be done dependably and eliminates the danger of exceeding the correct temperature in sone parts of the charge soaking periods. It will therefore be apparent that in annealing, hardening, tempering, normalising, case-hardening and the general heat-treatment of steels there is a definite field for the electric furnace. In recent years there has also been a marked development in special steels such as those of the stainless variety which at various stages require heating under conditions which preclude the possibility of their being licked by flame or coming into contact with any products of conbustion.

In the non-ferrous trades the electric furnace is being used for the melting of brass, copper, zinc, aluminium, gold, silver, etc., with conspicuous results.

Electric core drying stoves are growing in number although at the present time they are being used chiefly for small cores.

Another interesting application of growing importance is the vitreous enamelling of metals. With the advent of the electric furnace this ancient art has developed into a modern industry of no mean size.

It is a significant fact that in a large number of cases where electric furnaces are being used for this purpose, the cost of current consumption is actually greater than the corresponding cost of fuel, but the incidental and consequental savings are so considerable as to far outweigh this initial disadvantage.

We will turn to another protective coating for metals, which calls for much lower firing temperature. The baking of japan, paint, varnish, lacquer, etc., is a purpose for which the electrically heated oven is ideally suited. As a rule it gives an excellent finish, is clean and safe, and lends itself admirably to automatic control.

One of the best and most durable rust-proof coatings which can be given to iron and steel is that of zinc. The best method of applying it to articles of convenient size and shape is by the process now well known as sherardising. This process, with which most of you will be acquainted, calls for close temperature control. Most new installations are electrically heated. With autmatic control, labour requirements are considerably reduced.

In this connection there are now several electric galvanising installations in successful operation, using electricity for heating the zinc tanks.

We have referred to the annealing of steel and of non-ferruous metals and alloys. Let us turn for a moment to the annealing of glass, which is a duty which calls for just those features which are characteristic of the electric furnace. Accurate adjustment of temperature and even application of heat are prime essentials in this work. Shallow temperature gradients are required, *i.e.*, a sufficient volume of heat at the right temperature is called to rather than dependence upon considerable temperature difference between the source of heat and glass being treated. The ease with which electric heat may be controlled automatically is a great advantage as it eliminates or minimises labour requirements in a process which extends over long periods of time. The electric furnace or lehr is also a clean proposition as the ware does not absorb products of combustion and is free from sulphurage. Rejects due to breakage or distortion are practically eliminated.

I have made no attempt at even mentioning all the varied applications of electric heat to industry, nor do I regard it as necessary on an occasion like this. Sufficient has been said, I think, to indicate the practicability and value of electric heating as applied to industry in general and to a large number of specific applications in particular. Electric furnaces are being applied to many other specialised trades, including ceramic work, china-firing, decorating high-grade china, the firing of stained glass, etc., as well as for assay, test, and other purposes.

In conclusion may I say that I am fully conscious of the fact that here we have Gas and Electrical Engineers working together in close co-operation and harmony in the interests of smoke abatement. Competition will make for improvement in both directions and it is probable that each will learn from the other and benefit

Continued on page 36

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FROM THE MUNICIPALITIES

Under this heading will be printed each quarter reports of activities being carried out by the various Regional Committees, and other smoke abatement work of the municipal authorities. We invite such committees and other bodies to send us notes from time to time, and if possible, to appoint a correspondent who will be responsible for this.

WEST RIDING OF YORKSHIRE REGIONAL COMMITTEE.

The West Riding of Yorkshire Regional Smoke Abatement Committee in their efforts to combat the smoke nuisance are developing a new line of attack.

It is the firm conviction of the Committee that the stoker *can* be educated to take an intelligent interest in his work and by means of courses of training in various centres in the West Riding an opportunity is to be given to him of obtaining this education. Whether he will respond or not remains to be seen, but the Committee are confident that he will.

The course of training will lead up to an examination at which the knowledge he has gained will be put to the practical test. If he succeeds in passing the examination the Regional Committee will award him a special certificate. It is hoped that manufacturers in engaging stokers will give preference to men holding these certificates, and will also be prepared to pay them on a slightly higher scale than the uncertificated men.

An Examination Board has been formed to organise courses of training and arrange for examinations throughout the area. It will also prepare a syllabus of subjects for examination, set the examination papers and conduct and practical and oral tests. In this way a uniform standard will be established.

The Board will commence work in the near future and though in the beginning there is likely to be a good deal of hard ground to turn over and prejudices to overcome, the Committee is hopeful that success will crown its efforts.—J.J.J.

THE MANCHESTER AND DISTRICT REGIONAL COMMITTEE.

A meeting of representatives of the 103 Authorities in the Manchester Town Planning Area was convened, by the Ministry of Health in 1924 and resulted in the formation of The Manchester and District Smoke Abatement Committee.

It was hoped that eventually this Committee would be merged into a Statutory Committee with power to act over the whole area. Although this was fully discussed, and the principle approved by the Committee, the constituent authorities did not agree to it. The Committee has, however, discussed and agreed upon such questions as time concession, methods of inspection and definition of black smoke; problems concerning the use of gas, electricity and solid smokeless fuel; the making of bye-laws under the 1926 Act and many other subjects.

The Committee has taken an active part in smoke abatement propaganda in co-operation with the National Smoke Abatement Society, by giving lectures of both a popular and educational character and in the preparation of literature suitable for distribution.

Amongst the present activities is the preparation of a pamphlet especially suitable for distribution to steam raisers and a scheme for special addresses to manufacturers.

TYNESIDE.

Efforts have been made to establish a Reginional Smoke Abatement Committee on the Tyneside, and considerable progress had, at one time, been made towards this end. It was not found possible, owing to the attitude of certain authorities, to reach an agreed basis of association, and consequently the Committee has not yet come into being. It is hoped that the difficulties may be overcome, and that definite progress will be made in the formation of what would undoubtedly be an inavaluable factor in the campaign on the North-East coast.

GREATER LONDON REGIONAL COMMITTEE.

The Greater London Regional Smoke Abatement Committee, consists of representatives from the L.C.C., the City Corporation, the metropolitan boroughs, and urban district councils, the Port of London Sanitary Authority, the Federation of British Industries and the London Waterside and General Manufacturers' Association. The National Smoke Abatement Society is represented by its President, Dr. Des Voeux, who is a co-opted member.

A Conference held on October 15th received the report of the Committee which had beenset up to deal with the best methods of obtaining uniformity of action in dealing with the smoke nuisance in the London area. A number of recommendations were put forward, the most important of which was that the two minutes in thirty limit should be adopted, and that the local authorities should proceed to act under the 1926 Act. There was a minority Report, entitled "Reservation by Industrial Representatives."

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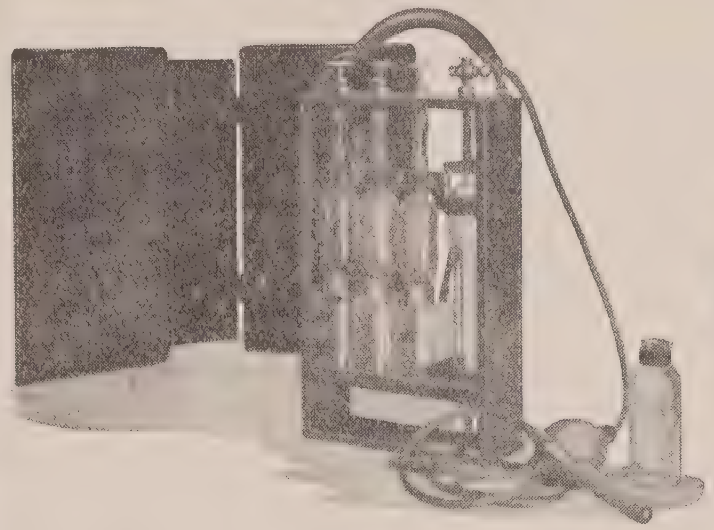

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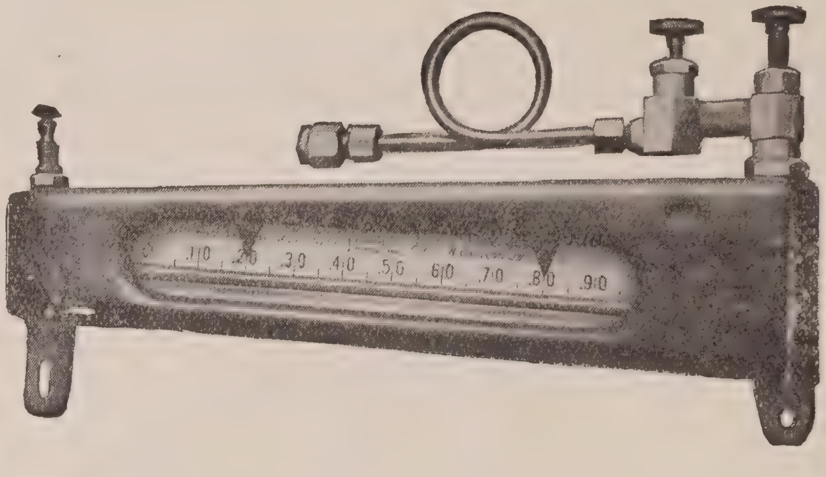

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Mr. Gwynne of the Federation of British Industries stated that the abatement of industrial smoke had economic and operative limitations. It was felt that the propagandists were unable to realise the problems raised or the technical details which limited fuel utilisation and smoke abatement. The adoption of the idealistic policy so vigorously preached by the propagandists would be very detrimental to industrial life and to the general economic well-being of manufacturers in London. If the majority report were adopted by the Conference it would mean the withdrawal of industry from the Committee. He moved an amendment to substitute three minutes for two in the recommendation concerning the time-limit.

This amendment was lost by a large majority, and the Conference adopted the majority report and its recommendations.

NOTTINGHAM.

The Nottingham Health Committee is considering the holding of classes for stokers, as one of the items in its smoke abatement work. The Medical Officer, Dr. Cyril Banks, is keenly interested in the subject.

DEWSBURY.

An advisory committee on smoke abatement is being formed in Dewsbury in conjunction with the Corporation Health Committee and the Chamber of Commerce. It is suggested that the committee shall consist of technical engineers; owners of plant and the local electrical engineer, and that its aims should be to advise the Health Committee on questions of practicability and to assist firms in difficulty with smoke emissions.

SHEFFIELD AND ROTHERHAM.

The Committee functioning in the above area is, we believe, the only Statutory Authority in the country set up under the provisions of the Smoke Abatement Act, 1926.

The standard fixed by the Joint Committee with regard to emissions of smoke is as follows :—

Where there is 1 boiler attached to a chimney, 2 minutes per hour.

Where there is 2 boilers attached to a chimney, 2 minutes per hour.

Where there is 3 boilers attached to a chimney, 4 minutes per hour.

Where there is 4 or more boilers attached to a chimney, 6 minutes per hour. Maximum.

This standard is accpeted by the Sheffield Magistrates as reasonable, and it is also intersting to note is not contested by the manufacturers so far as boilers are concerned.

The difficulty experienced has been in connection with combination chimneys, *i.e.*, chimneys serving boilers and furnaces. Also furnace chimneys. In order to assist in arriving at some conclusion on this subject research is at present going on through a Joint Advisory Committee consisting of members of the Statutory Authority and representatives of the Manufacturers, presided over by Professor C. H. Desch, F.R.S. It is hoped that the result of this Committee's investigations will be to find some method of rendering unnecessary the discharge of smoke into the atmosphere from furnace and combination chimneys.

The Authority has been busily engaged endeavouring to extend the area of control, and had already been successful in persuading the following Authorities to join up :- Stocksbridge Urban District Council, Rawmarsh Urban District Council, and Rotherham Rural District Council. Further negotiations are proceeding, which it is hoped will be successful.—W.A.

THE MIDLANDS COUNCIL.

The Midlands Joint Advisory Council for Smoke Abatement was formed in 1927, following on a preliminary conference at Birmingham in April among delegates from local Authorities in the Midlands. It includes representatives from a total of 53 urban and rural Authorities. The Executive Committee appointed by the Council proceeded by means of a questionnaire to collect systematic information as to the position of the smoke problem in the constituent areas. This inquiry served to shew the very diverse practices existing in agard to the procedure for smoke abatement. Accordingly it was felt that the first step towards uniform action would be the adoption by individual authorities of bye-laws for smoke abatement under the terms of the 1926 Act. A number of the urban areas represented on the Council are proposing to adopt such a bye-law, in some cases on the standard laid down in the model bye-law, in others on the basis of three minutes' black smoke in 30 minutes. In certain district the application of the bye-law has been opposed by brick-making firms, and in Birmingham a local inquiry was held in September in respect of such opposition. The Ministry's decision has not yet been promulgated. Arrangements have been made for the retention of an expert adviser on smoke abatement whose services will be available to the various Midland authorities in connection with work aimed at suppression of the smoke nuisance.—H.P.N.

CURRENT EVENTS

THE MANCHESTER EXHIBITION.

The Manchester Smoke Abatement Exhibition, under the auspices of the Society, and organised by the *Daily Dispatch* and Provincial Exhibitions Ltd., will be held from November 5th to 16th in the City Hall, Manchester. The Exhibition will give a wide and comprehensive survey of the many types of smokeless fuels, the methods of using these fuels to the best advantage, and appliances and processes designed to eliminate industrial smoke. The Society will have a stand on which will be shown its literature and some entirely new exhibits. All readers who are in Manchester during the period are urged to visit the show, as it will undoubtedly be of great interest and value to all who are connected with smoke abatement. It will be fully reported in the next issue of CLEAN AIR, but in the meantime we would like to express our thanks to the organisers and to the *Daily Dispatch* for the splendid assistance they are giving to the smoke abatement cause. It is especially gratifying to see a popular newspaper devoting itself to a subject generally so neglected by its contemporaries.

THE SCOTTISH BRANCH.

The Scottish Branch of the Society is going ahead with much useful work, and this winter is once again holding its Firemen's Classes, 97 firemen have enrolled for this season, which means that by now over a thousand men have taken advantage of these courses. The Branch under the Hon. Presidency of Sir Alexander Stevenson, Lord Provost of Edinburgh, and the Acting Presidency of Mr. W. Brownhill Smith, has thirty-five local authorities and institutions affiliated to it. The Secretary and Hon. Treasurer is Mr. Allan Stevenson, whose address is City Chambers, Glasgow.

SMOKE ABATEMENT BYE-LAWS IN BRISTOL.

The Bristol Corporation is applying for a bye-law under the 1926 Act. The Health Committee recomenmended that a period of two minutes black smoke emission in the half-hour should be taken as the standard, but considerable opposition was raised to this proposal by the Federation of British Industries and other manufacturing interests, which put forward a counter-proposal of four minutes in the half-hour. As a result, a compromise has been reached, and the Health Committee has agreed to a period of three minutes. It is reported to have been stated that " there was machinery which would make two minutes a safe period, but it would mean a great expenditure to impose on industry." Comment is superfluous.

THE QUESTION OF BRICKS.

The Birmingham Corporation has also applied for confirmation of a bye-law under the 1926 Act, in which a period of three minutes black smoke emission is laid down. This has aroused opposition among only one section of the Local industries, that of brickmaking. A Ministry of Health inquiry has been held in Birmingham on the matter the result of which has not yet been published. For the manufacturers it was stated that great hardship would ensue in the industry if the bye-law was enforced, as it was impossible to avoid the production of smoke. It was further stated that it might mean the closing down of some works. For the Corporation it was contended that while smoke was unavoidable from the Scotch or open kiln it was not necessary in using the Belgian or Hoffmann continuous kiln, and that in Birmingham almost all the kilns in use were of the latter type.

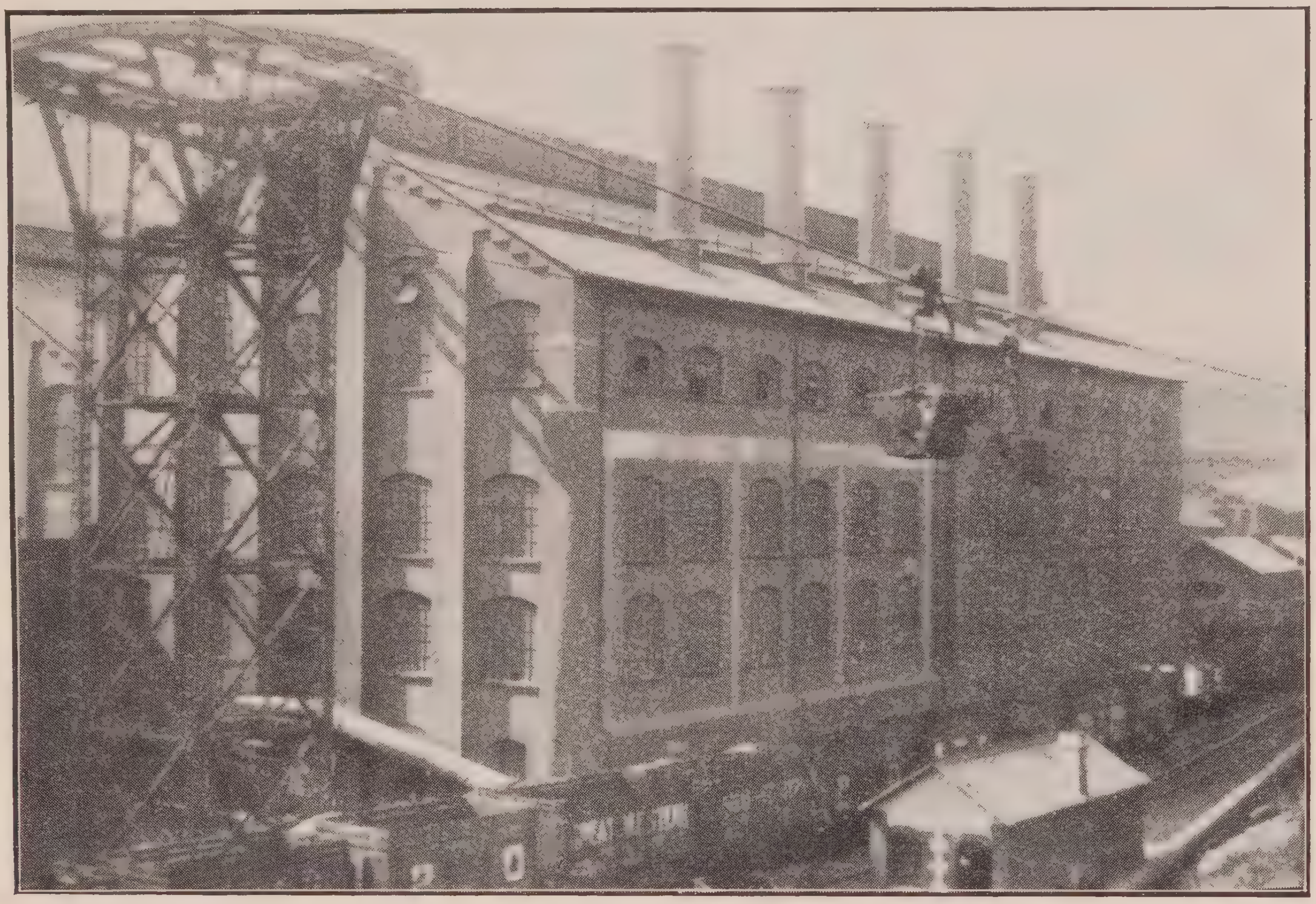
BENJAMIN FRANKLIN ON SMOKE ABATEMENT.

We are indebted to Mr. R. B. Hovey, writing in a letter to *The Manchester Guardian*, for the following extract from a letter written in 1766 by Benjamin Franklin to Matthew Boulton, who was afterwards partner to James Watts. Many manufacturers would do well, even to-day, to learn it by heart :—

> " Would only repeat to you the hint that I gave of fixing your grate in such a manner as to burn all your smoke. I think a great deal of fuel would then be saved, for two reasons. One that smoke is fuel, and is wasted when it escapes unflamed. The other, that it forms a sooty crust on the bottom of the boiler, which crust, not being a good conductor of heat, and preventing flame and hot air coming into immediate contact with the vessel, lessens their effect in giving heat to the water. All that is necessary is to make the smoke of fresh coals pass descending through those that are already thoroughly ignited."

The Uses and Development of Electricity in Industry—*contd. from page* 31

by the other's experience in the future as in the past. Supply Authorities—both Gas and Electric—will always exercise a very important influence since their charges to the consumer will continue, in many cases, to be a deciding factor, where fuel costs are a first consideration. Personally, I never hesitate to dissuade a manufacturer or engineer from putting in electric furnaces if I am convinced that a fuel-fired furnace would be preferable, after all factors have been taken into consideration. As I explained at the commencement, this is not necessarily from altruistic motives but it is done out of jealousy for the electric furnace and industrial electric heating business. One white elephant attracts far more attention than a hundred normal ones.



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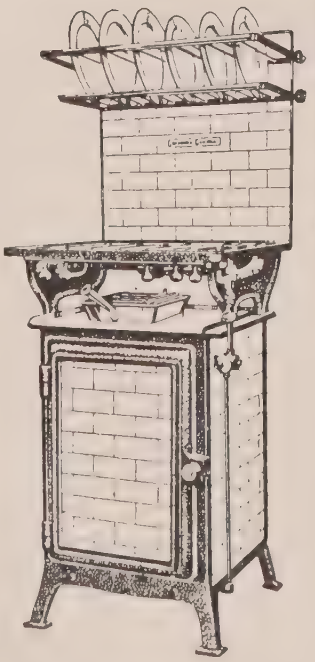

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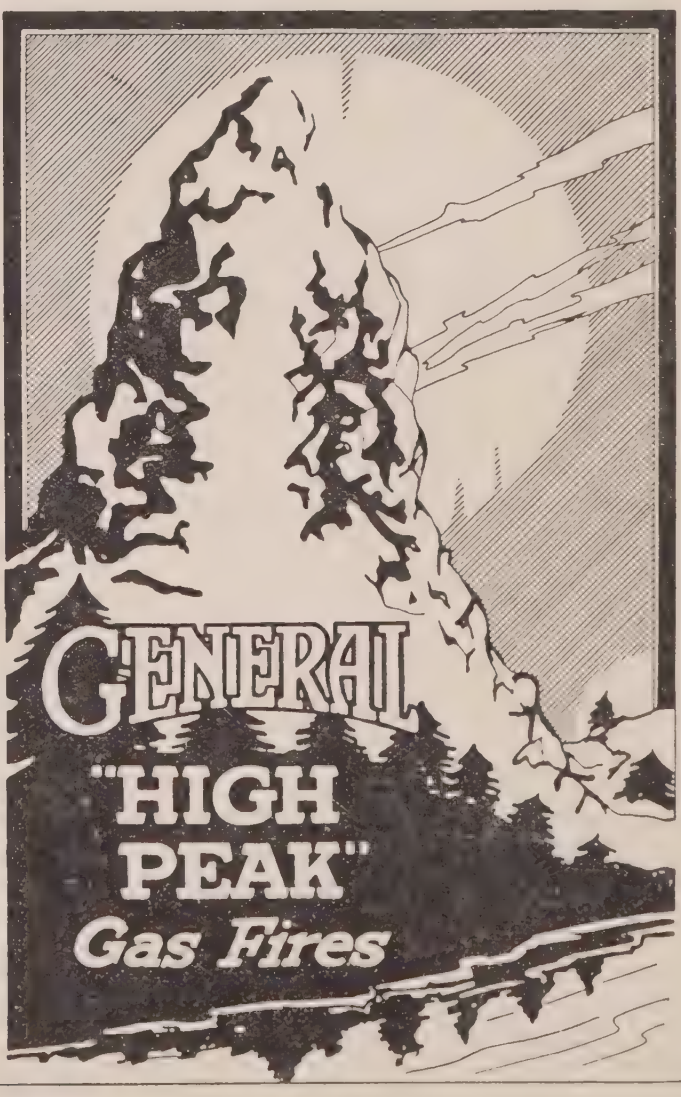

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CONTENTS OF SPRING ISSUE

Page
Commentary 39
The Cost of Smoke 41
From the Municipalities and Branches .. 45
Current Events 47
" Fumifugium ".. 47
Farnworth and the Manchester Corporation 53
The Manchester Exhibition 55
Publications Received 57

Page
" Anti-Smoke " Slogans 57

A Survey of the Smoke Problem. Lecture Reports :

Coal and its Combustion 58
Smoke and Health 58
Smokeless Fuels 61
Abatement of Domestic Smoke 61
Abatement of Industrial Smoke.. .. 63
General Aspects of the Smoke Problem .. 63

COMMENTARY

THE first issue of our Journal has met with a good reception, and there have been many favourable reviews and notices in the Press. One of the most interesting and erudite is from " Nature," which says : " In the next century commentors will scarcely fail to remark on the fact that in the nineteenth and twentieth centuries, cultivated and intelligent people remained apathetic towards the pollution of the atmosphere by smoke. They will note the display of resistance, active and passive, towards this hygenic reform, characteristic of slum dwellers, yet exhibited by even the most refined who would never tolerate the least defect in sanitation, public and domestic. That the reform is in train can scarcely be denied, and one sign is the appearance of a quarterly periodical . . . . . . which reveals the existence of a body of opinion interested in a wide range of activities . . . . . the advantages of bringing these activities into a common focus is undeniable."

* * * * *

By a rather unfortunate coincidence, another propaganda society, the National Society of Non-Smokers, has taken the name " Clean Air " for its official publication ; a fact that was not discovered until after the publication of our first number. As the others were first in the field, and also because it was not desired to cause any confusion between the two, it has been decided to give an entirely new title to this Journal. The change will come into operation in the next issue. The new name has not yet been definitely chosen, but those under consideration are " The Smokeless World " ; " Smokeless Britain " and " The Smoke Abatement Journal." We would be obliged if readers would let us know their preferences, or even make further suggestions—among which might well be that perfect and final name which has so far eluded us.

* * * * *

Everyone interested in smoke abatement must have been extremely gratified to find the name of our Advisory Secretary figuring in the New Year's Honours List. Sir Lawrence Chubb plays many parts in a wonderfully efficient fashion, and it is chiefly because of his long and incalculable service as the defender of our commons and footpaths that he has received this recognition. Even though it was not mentioned in the notes attached to the official list, we hope that his thirty years as secretary of the Coal Smoke Abatement Society are also being recognised. While guarding full well our open spaces and the tracks that wind across them, Sir Lawrence has also found time to do much to cleanse the breezes that sweep over them, and the congratulations of the readers of this Journal will therefore possess a special and additional warmth.

The Barton Power Station case which is dealt with elsewhere in this issue, will undoubtedly give an impetus to those who are directly concerned with the problem. Those who are interested in the purification of the atmosphere are anxiously awaiting the time when the complete elimination of sulphur acids from the waste gases will have been accomplished. While we are busy advocating the use of electricity for domestic and industrial purposes, as one of the most valuable mediums making for smokeless conditions, we do not wish any locality to have to be drenched in a continuous spray of sulphuric acid, which is rather a heavy price to have to pay for clean air elsewhere. Although, as Dr. Des Voeux has pointed out, the total amount of sulphur poured into the atmosphere will not be increased by an increase in the use of electricity, it is the heavy concentration that is the bugbear. Mr. Farnworth, the plaintiff in the case, has had the generous support and backing of the National Farmers' Union. This organisation should be congratulated on having rendered possible a legal finding of the utmost importance. As many researches have shown, pure air is vital to the healthy growth of plant life, and no section of the community should have a greater interest in smoke abatement than the agriculturist—especially those on the outskirts of our large towns and industrial districts.

* * * * *

In an interesting paper to the Royal Meteorological Society, Dr. J. R. Ashworth (a member of the Executive of the N.S.A.S.) dealt with the influence of hot smoke and hot gases from factory chimneys upon rainfall. During investigations on atmospheric poloution it was accidentally discovered that the average rainfall in Rochdale was less on Sundays than on any other day in the week ; being 13% less than the average of all other days, during the last ten years. At Stonyhurst, at no great distance, but in a rural area, the Sunday rainfall was only 6% below the average, and further, is not the day of least rainfall. Dr. Ashworth showed also that whereas on weekdays there was heavier fall of rain during the day than the night, on Sundays this was completely reversed, there being appreciably less during the day with the lightest rate of rainfall. From these, and similar observations, it is deduced that the emission of smoke and hot gases from the chimneys of Rochdale has a definite effect upon the rainfall, although it cannot be stated to how far this influence extends.

* * * * *

Mr. Alderman Melland, the Society's Chairman and Hon. Treasurer, in his article in this issue stresses a point which is frequently unconsidered, in showing how the objects of our work from the health aspect, are essentially preventive. While it is true, as he states, that many prefer to support preventive institutions rather than hospitals, it is remarkable what a small proportion of the philanthropic do act in this way. On the whole, preventive organisations would appear to be fewer and poorer than those wholly curative. While the latter class must be supported, would it not be well to look ahead and try to reduce their requirements by means of more preventive measures ? One would think that such reasoning would be common to all, and that the purification of the atmosphere would be taken as one of the foremost preventive measures. So one would imagine, and yet we have still to receive our first legacy !

* * * * *

Extract from a report of a test on a smoke consuming device on a steamship as related in an American paper :—

" From dense black clouds of smoke belching from the funnel of the *Dalzellido* the smoke carburetor turned the fumes into a light brown and then a blond emission within a few seconds." Like other gentlemen, smoke reformers prefer blondes !

> " Parliament has done its duty in legislation, but we have not yet got effective local administration. I am not going to blame anybody for that, but I say that this legislation is worse than useless unless it is actively and courageously put into operation by the authorities whose duty it is to administer the law."
>
> *The Minister of Health.*

The Cost of Smoke

IS Prevention better than Cure?

By Alderman Will Melland, J.P.

The great damage done by smoke has become so much a normal state of affairs that we hardly notice it. This is not a parodox but is merely an illustration of the general law that we only notice things that are exceptional. The effects of smoke in the great industrial centres are not exceptional but universal. The damage is both aesthetic and economic. The look of things suffers and the value of things suffers, everybody suffers and since everybody suffers, it is a long time before anybody protests. If the damage were done suddenly, there would be a general outcry, but it is done gradually. Thousands of people live their lives from start to finish in the midst of smoke and have come to regard it as a normal condition of life. It is only in modern times that we have realised that the nuisance is preventable and that public economy, public health and happiness alike call for its prevention.

Not only does smoke mean waste but it causes further waste. Everybody knows how much it disfigures, but it is not generally realised how much it destroys. It effects buildings, merchandise, gardens, furniture, clothes, decorations and last but not least, personal health and even we might say personal appearance. Smoke also seriously diminishes the amount of daylight and thereby entails additional expense as regards artificial lighting.

To quote a few examples :—in 1912 the Manchester Public Health Committee issued a number of questionnaires to all kinds of people; householders, superintendents of hospitals, architects, house painters, property owners, hotel and restaurant proprietors, owners of warehouses, works and gardens, whose opinions would be likely to enable them to make a fairly accurate estimate of the damage done. Taken in the mass the replies constituted a heavy indictment against smoke, not only as a disfiguring but as a destructive agency. Architects and Property Owners, for instance, said that a clean atmosphere would reduce the cost of upkeep and maintenance of buildings by 50%. In this connection it is interesting to note that Sir Frank Baines, Director of His Majesty's Works said in 1924 that if the air were as clear and pure in towns as it is in the rural districts he would estimate that at the very least £120,000 per annum could be saved upon the maintenance of official buildings in the charge of his department, which would mean that the saving in annual charges might well be found to be from 30 to 40% of the present day costs.

Warehouse owners say "We have to protect our goods by wrapping each parcel in extra paper. The indirect damage done to dyed and bleached goods is very serious and loss of trade is bound to result."

The only section of the people who did not grumble about the smoke, were the house painters and decorators and this for obvious reasons.

Exhaustive Enquiry.

A most exhaustive enquiry was held respecting the cost of the weekly family wash in Manchester as compared with a clean town like Harrogate and it was conclusively proved that owing to its dirty atmosphere the people of Manchester were spending £242,000 per annum more on their family wash than they would have done if the air of the City were as clean as that of Harrogate. This enquiry took no account of the extra wear and tear of the clothes due to more frequent washing, a very serious item touched upon by Mr. R. H. Clayton, B.Sc., in a paper read at a Smoke Abatement Conference in 1909 :—"*The Conservation of finished products is all the more important in that it not only includes the raw material used in the manufacture but also the labour involved in producing the various articles in daily use. It seems to me very illogical to spend our time and energy in producing an article cheaply, in going to great expense in providing the latest machinery to produce cheaply and with the finest finish, and then to submit the article produced with all these expenses on it to conditions which reduce its life to an enormous extent and more than take away any economy effected in its manufacture, so that we nullify much of the work done and energy and thought expended. I refer to the filthy condition of our towns atmophere due to the pollution by smoke.*"

It is interesting to read some remarks by Dr. J. J. Jervis, the Medical Officer of Health for Leeds :—"*In permitting the pollution of the air, from which we take the oxygen that enables our tissues to carry out their functions, we are doing disservice to our own generation and inflicting a handicap on future generations. If the child is deprived of fresh air and sunshino there is taken from him the material which is going to enable him to build up a perfect body, and, in the course of time, an efficient mentality. We could not justify the pollution of the atmosphere or the squandering of our rich preserves of coal, which are not illimitable. The respiratory diseases which are due to the pollution of the atmosphere are not only the cause of many deaths but have a damaging and crippling effect on mind and body.*"

The damage done to vegetation by smoke is very marked indeed and Professor J. B. Cohen of Leeds has conducted many most interesting experiments in proof of this. The dying off of trees, shrubs and flowers in the gardens and public parks of our large industrial centres constitutes a heavy charge on the local rates.

Spring Cleanliness
Every Day

Electricity Ensures Clean Air Everywhere

In your attack on dust and dirt every day your best aid is an Electric Suction Cleaner.

The Electric way of cleaning, collects dirt and allows it to be destroyed without danger to health or scattering the dust everywhere.

It is important in a house where there are children that the floor should be free from germ-carrying dust.

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Send for a free copy of "The House you Want"
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THE BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION, INC.
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In a group of 12 parks situated in a well-known city, no less than £1,420 is spent annually in replacing the vegetation killed off by smoke and fumes.

Many and various are the losses due directly and indirectly to smoke and only a few instances can be particularised for their name is legion. Perhaps one more may be mentioned and it is one probably very rarely taken into consideration. Complaints are heard on all sides of the difficulty in persuading cultured men and women to take part in the local government of their towns owing largely to their living at a considerable distance from their work so as to escape the smoke cloud. By those who can afford it the rush from the City is very general and is a deplorable feature in the development of modern life.

" FUMIFUGIUM."

It is interesting to note that John Evelyn (a contemporary of Pepys) in his book " Fumifugium " or " The Inconvenience of the Aer," (which is dealt with in another article in this issue) published in 1661, states as follows :—

" *There is, I confess, a certain Idiosyncrasia in the Composition of some persons, which may fit and dispose them to thrive better in some Aers, than in another : But, it is manifest that those who repair to London, no sooner enter into it, but they find a universal alteration in their Bodies, which are either dryed up or enflamed, the humours being exasperated and made apt to putrifie, their sensories and perspiration so exceedingly stopped, with the losse of Appetite, and a kind of general stupefaction, succeeded with such Catharrs and Distillations, as do never, or very rarely quit them, without some further Symptones of dangerous Inconveniency so long as they abide in the place ; which yet are immediately restored to their former habit, so soon as they are retired to their Homes and enjoy the fresh Aer again. And here I may not omit to mention what a most Learned Physician, and one of the College, assured me, as I remember of a Friend of his, who had so strange an Antipathy to the Aer of London ; that though he were a Merchant, and had frequent business in the City, was yet constrained to make his Dwelling some miles without it ; and when he came to the Exchange, within an hour or two, grew so extremely indisposed, that (as if out of proper Element) he was forced to take horse (which used therefore, constantly to attend him at the Entrance) and ride as for his Life, till he came into the Fields, and was returning home again, which is an Instance so extraordinary, as not, it may be, to be paralell'd in any place of Europe, save the Grotto del Cane, nere Naples, the Os Plutonium of Silvius, or some such subterranean habitation. For Diseases proceed not from so long a Series of causes, as we are apt to conceive ; but, most times from those obvious, and despicable mischiefs, which yet we take lesse notice of, because they are familiar; But how frequently do we hear men say (speaking of some deceased Neighbour or Friend) He went up to London, and took a great Cold, etc. which he could never afterwards claw off again.*"

There are many people who refuse to subscribe to hospitals and kindred institutions on the grounds thta they prefer to support preventive rather than curative movements and this attitude is very understandable. The National Smoke Abatement Society's activities are essentially preventive in nature and should be supported not only by individuals who realise the vast importance of its work but also by all Local Authorities who are primarily responsible for the health and well-being of their people and by business firms and shops which all suffer, and suffer acutely, economic loss from the smoke evil.

THE MONEY DEVOTED.

The amount of money devoted to the cleansing of the atmosphere by local authorities is ridiculously small when compared with the vast sums spent in repairing the ravages of smoke, and correspondingly the support which has been given to the Society is but as a drop in this ocean. In heavier bills, higher prices, taxes and rates, every person pays his quota of the £80,000,000 a year bill, which is the estimated total cost, and every section of industry and commerce, in increased overhead charges, does likewise. Even one pound in every ten thousand of this sum, if spent wisely, would mean the saving of an ever-increasing proportion of the total. It is from such a point of view and with such an object that the Society asks for a chance, and feels justified in doing so.

The Smoke Abatement enthusiasts have in past years more often than not had their crusade in the face of ignorance and apathy but the minority convictions of one generation often become the commonplace of the next and the time is fast approaching when governing bodies and members of the general public will become much more aware of the vast importance of this subject.

" Smoke is waste. One thing that above all else is needed to restore economic prosperity is economic efficiency. Waste and efficiency cannot stand together, therefore it is a business proposition to eliminate this waste."

The Minister of Health.

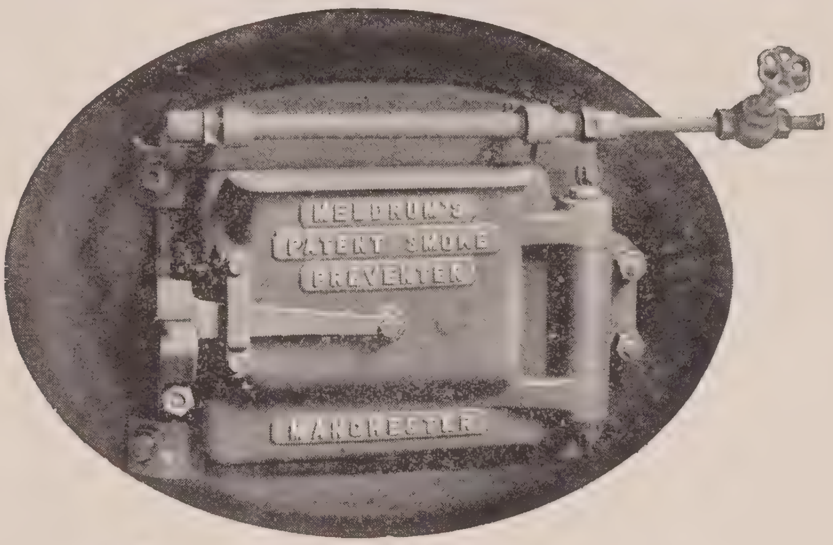
Glasgow Corporation are making application to the Secretary of State for Scotland for a new Provincial Order ; of which one clause suggests that railways in the city shall be worked by electricity or other motive power, the use of which does not involve the emission of smoke.

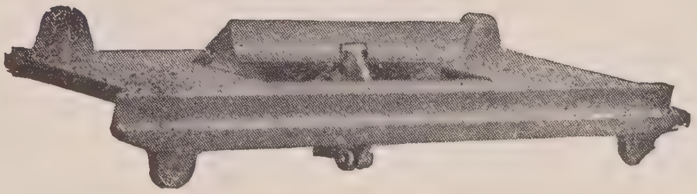
SMOKE-CURE WITH SAVINGS—
THE "MELDRUM" WAY

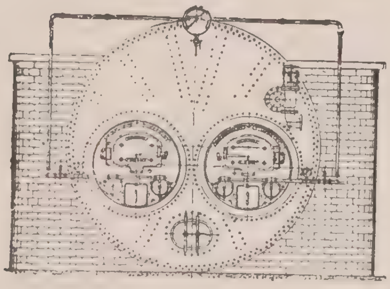
POSITIVE FEATURES (not found on any other system)
PRODUCE POSITIVE RESULTS.

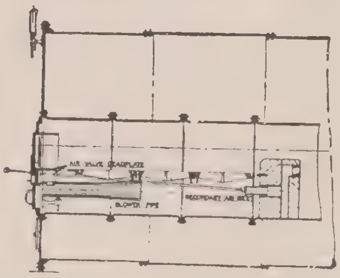
The "Meldrum" System utilises a closed Ashpit under positive pressure so that the admission of secondary air is not dependent upon Chimney pull but is produced **under the Firebed** and its effect is instantaneous and quite independent of atmospheric conditions. In the case of

THE HANDFIRED FORCED DRAUGHT FURNACE :—









For Vertical Cochran & Loco. Type Boilers—A double or hollow door takes the place of the ordinary firedoor, As will be seen, secondary air is forced down and through this door by steam-jet under control by Wheel Valve.

For Lancs., Cornish, Marine and Yorkshire Type Boilers also Coppers, Kilns & Heating Furnaces :— A Valve in the deadplate (2nd view) opens automatically by the closing of the firedoor. This valve is connected with the closed ashpit under pressure. The third view shows our Patent Split Bridge—also connected with closed ashpit—both features give instantaneous and positive results.

For Watertube Boilers :—Similar features to the last mentioned are used, with the addition of extra air blowers over the firedoors according to duty required and kind of fuel.

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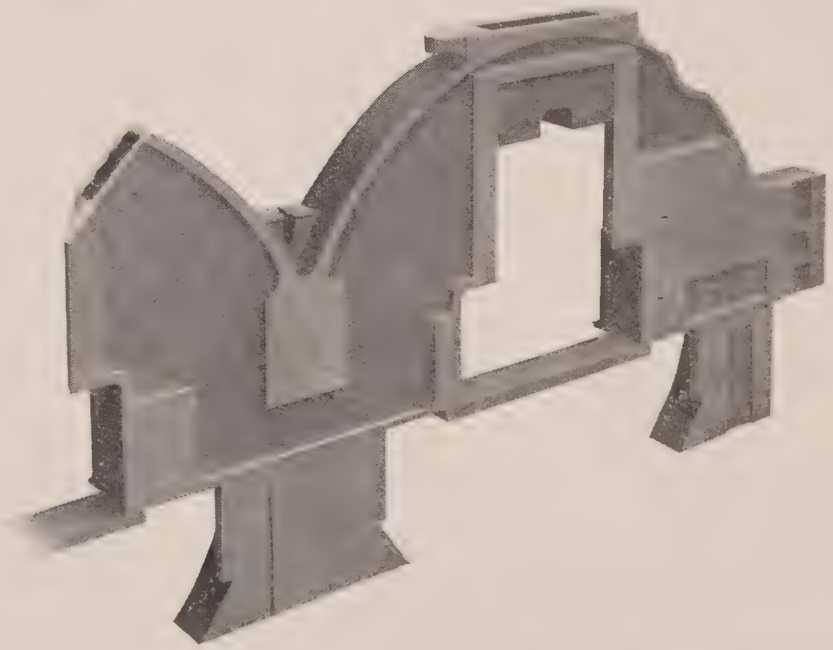


From the Municipalities and Branches

The Scottish Branch.

The Annual Meeting and Conference of the Scottish Branch which took place in the City Chambers, Edinburgh, on 3rd May, 1929, proved to be most successful. The Council Hall, which had been kindly put at the disposal of the Branch, was well filled, there being present 82 representatives of Local Authorities and other bodies interested in the problem of smoke abatement.

The thanks of the Branch are due to the Edinburgh Officials who contributed interesting and instructive papers on the various aspects of the smoke evil. Dr. Robertson, Medical Officer of Health, treated the subject from the public health point of view, and was ably supported by Professor Lelean of the Edinburgh University, Dr. Macgregor, Medical Officer of Health, Glasgow, and Mr. Peter Fyfe, one of the original promoters of this Branch of the Society. Mr. Jeffery, Superintendent of Parks and Gardens, Edinburgh, dealt with the subject from the point of view of damage done by smoke to trees, flowers and vegetation generally, while Mr. MacRae, the City Architect, as also Mr. Wilson of the Department of Health, rendered papers on the injury of smoke on buildings, etc.

The evening session was devoted to the ladies and Mrs. Councillor Somerville, Edinburgh, read a paper dealing particularly with the evil effect of smoke upon child life. Lady Leslie Mackenzie, Edinburgh, who occupied the Chair at this session, Bailie Miss Robertson, Glasgow, Miss Jack, Edinburgh, and Miss Knox, Glasgow, with other ladies present contributed to the discussion, which resulted in a most interesting and instructive meeting.

It is very encouraging to note that the classes for firemen, which have been carried on by the Scottish Branch since its inception in 1909, seem to have taken a new lease on life. Up to the present year the numbers of firemen enrolled for these classes have varied from 80 to 50 but this year the number is 110.

It is also interesting to note that this year the directors of the Heriot-Watt College, Edinburgh, with some assistance from the Scottish Branch, instituted a course of lectures on the subject of smoke abatement, which passed off very satisfactorily.

West Riding of Yorkshire Regional Committee.

Further progress has been made with the scheme for the training of stokers and boiler firemen. An Examination Board consisting of seven members—three being representatives of the Regional Smoke Abatement Committee, one an expert Boiler Engineer, two Principals of the most important Technical Colleges in the area, and one a member of the staff of the Fuel Department of the Leeds University—has been set up and has already met on two occasions and formulated a syllabus, copies of which have been distributed to Local Education Authorities for their comments and criticisms.

The Committee hopes to be in the position to send a copy of the syllabus as finally approved to the Journal for publication in a further issue.

THE ANALYSIS OF FUEL SAMPLES.

The consideration of the question of the use of correct fuel for particular requirements is a subject to which smoke abatement experts might give further attention.

In these enlightened days our own bodily needs are carefully attended to. This is the day of specialised dietaries. Our wants are supplied by the carefully selected and balanced food constituents the nutrient value of which is based on accurate analysis, the whole dietary being combined with mathematical exactness.

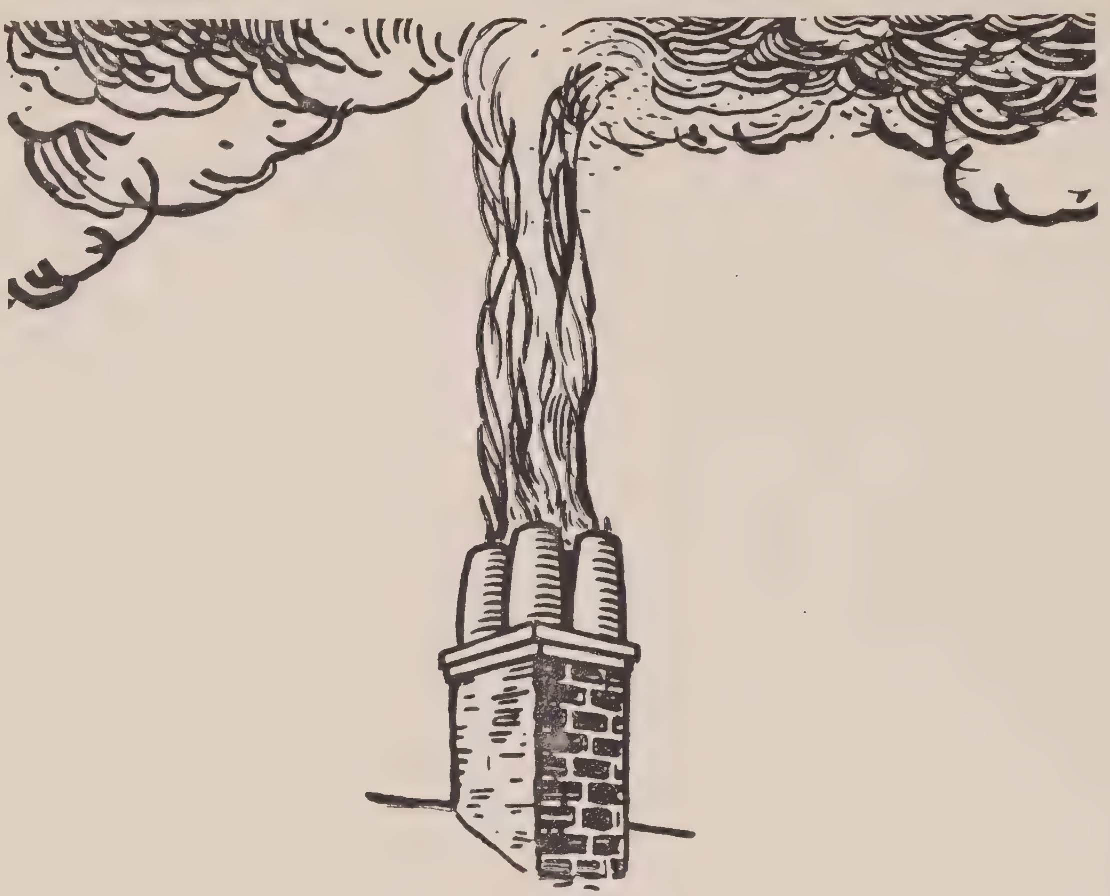
Is not the question of our fuel requirements worthy of similar careful consideration? Is not a well-balanced fuel just as necessary for the factory furnace as a well-balanced diet for the human machine? The need is just as essential if not more so; neglect by an individual injures himself only; neglect by fuel consumers lays a burden on the whole community.

The West Riding of Yorkshire Advisory Committee on Smoke Abatement is endeavouring to bring to manufacturers a realization of the advantages to be derived from the use of fuel of which the analysis is known and which therefore can be relied upon to give the best thermal output for their own requirements. In some of the larger towns facilities are provided by the Local Authorities through their Gas and Electricity undertakings for the analysis of fuel samples at a cheap rate. Failing the provision of these facilities by the Local Authorities there are always private fuel specialists who will undertake the work at a moderate fee. In many cases however, a simple analysis can be obtained from the Colliery Proprietors from which the fuel is purchased.

It is hoped therefore, that Manufacturers will appreciate the value of taking advantage of such facilities for the analysis of fuel as do exist and that Local Authorities on their part will not be backward in supplying the necessary incentive by providing these facilities where they do not already exist.

Manchester and District Regional Smoke Abatement Committee.

Meetings of the Executive Committee and of the full Regional Committee were held in November and December, 1929. Reports were received from the Honorary Secretary as to propaganda work, sale of literature, lectures given and arranged.



GAS FIRES

GAS COOKERS

ENSURE

CLEAR SKIES

BY

USING GAS

GAS WASH BOILERS

THE IDEAL
SMOKELESS FUEL

GAS RADIATORS

It was specially urged and endorsed by the Committee that all the local authorities and members of the Regional Committee should make known and have distributed the pamphlet "Smoke abatement and fuel economy in Steam Boiler practice."

A number of questions re smokeless fuel and other matters were raised and discussed and referred for further consideration at the next meeting of the Executive, several members being asked to investigate and report on certain points.

Current Events

The Birmingham Byelaw.

The Minister of Health has decided to confirm the Birmingham Corporation byelaw under the 1926 Act, subject to the exclusion of all brick-kilns fired from the bottom. The Corporation offered to exclude only "open" or "Scotch" kilns for three years, but Mr. Greenwood has decided that these and other kilns shall be excluded from the byelaw, and his certificate of confirmation will not specify any fixed period of exclusion.

The Midland Council of the National Union of manufacturers in discussing the matter passed a resolution showing that the City Council, with unlimited resources was itself unable to comply with the byelaw, particularly at its electric power stations. "In these circumstances," states the resolution, "the Midland Council points out to the Birmingham Corporation that it would be a gross injustice to take action against any private individual for an infringement of a byelaw which itself is powerless to obey."

Such a resolution, logically true, emphasizes the necessity for municipal authorities taking every possible step to keep their own houses in order. In addition to power stations, public baths and wash houses are frequent offenders, and further, we would like to inquire how many public health departments are still using raw coal in open grates or in their boiler furnaces?

Low Temperature Carbonization.

The reports of the Annual Meetings of Low Temperature Carbonization Ltd., and of the Illingworth Carbonization Co. Ltd., are encouraging and show marked progress.

Mr. S. E. Illingworth, Chairman of the latter company stated that the capital which has been arranged for operating the process amounts to more than £1,000,000. The Board did not desire to sell out the process, but rather to have a share in each company operating. The fuel "Ricoal" was having an ever increasing demand. So far, it had not been necessary for them to ask the public for money to erect plant as they had the support of the largest and best interests. During the year six subsidiary companies had been formed. The plant being erected in Kent for Messrs. Pearson Dorman and Long would be in operation early in the new year, while the one at Allerton near Leeds would also be operating shortly. A 250 ton per day plant is being erected in France and a further one has been arranged for, while in Italy a 500 ton per day plant was proceeding well. Arrangements were being made for plants in Australia, U.S.A. and Canada.

Low Temperature Carbonization Ltd., has earned a trading profit and a net loss of only £4,497 on fifteen months, compared with a loss of £24,087 on the twelve months previous. The Barugh works have been in constant operation day and night during the whole of the fifteen months, and have carbonized, up to October 31st, 1929, 136,720 tons of coal, giving approximately 95,704 tons of coalite, 2,324,240 gallons of crude coal oil and 273,440 gallons of coal petrol.

The Askern works, opened during the summer, provide a favourable report, while a third plant is being erected at East Greenwich for the South Metropolitan Gas Co. It is stated that the demand for coalite is quite adequate to absorb the company's production.

"Fumifugium"

The First Smoke Abatement Pamphlet.

John Evelyn, author of the famous Diary, and contemporary of Samuel Pepys, would have an excellent chance of being chosen as the patron saint of Smoke Abatement, if ever such an office was created, for he was one of the earliest and most forceful of the apostles of air purification, and in his pamphlet "Fumifugium" we find an admirable attack on the problem of smoke as London in 1661 knew it.

Although the style and archaism renders the book amusing to the reader to-day, it is surprising to find that, stripped of its trappings, how closely the subject matter resembles that of our present efforts. At least, the indictment of smoke is similar, although the proposed remedies would hardly be considered satisfactory to-day.

The *Times* has suggested that some body should reprint the pamphlet in an inexpensive form, so that it

FOR CLEAN AIR AND
MAXIMUM SUNLIGHT

USE THE SMOKELESS COAL
NATURE HAS HERSELF PROVIDED

ANTHRACITE

ABSOLUTELY SMOKELESS
HIGHEST IN CARBON, LOWEST IN ASH
VERY SLOW BURNING
SAFE, CLEAN AND ECONOMICAL IN USE
MINIMUM ATTENTION—IT NEVER GOES OUT

THE BEST FUEL FOR—
DOMESTIC HOT WATER BOILERS
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ENQUIRIES AND DESCRIPTIVE LEAFLETS :—

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would be available to all. This the Society hopes to be able to do at some future date, but in the meantime the extracts given below will be of value and interest to our readers :—

THAT men whose very Being is *Aer*, should not breathe it freely when they may ; but (as that *Tyrant* used his Vassals) condemn themselves to this misery & *fumo praefocari*, is strange stupidity : yet thus we see them walk and converse in *London*, pursued and haunted by that infernal Smoake, and the funest accidents which accompany it wheresoever they retire.

That this Glorious and Antient City, from Wood might be rendred Brick, and (like another Rome) from Brick made Stone and Marble ; which commands the Proud Ocean to the *Indies*, and reaches the farthest *Antipodes*, should wrap her stately head in Clowds of Smoake and Sulphur, so full of Stink and Darknesse, I deplore with just Indignation.

The Body feeds upon *Meats* commonly, but at certain periods and stated times, be it twice a day or oftner ; whereas, upon the *Aer*, or what accompanies it (*est enim in ipso Aere occultus vitae cibus*) it is alwayes preying, sleeping or waking ; and therefore, doubtless, the election of this constant and assiduous Food, should sometimes concerne us, I affirme, more than the very *Meat* we eat, whereof so little and indifferent nourishes and satisfies the most temperate and best Educated persons. Besides, *Aer* that is corrupt insinuates itself into vital parts immediately ; whereas the meats which we take, though never so ill conditioned, require time for the concoction, by which its effects are greatly mitigated ; whereas the other, passing so speedily to the Lungs, and virtually to the Heart itself, is derived and communicated over the whole masse : In a word, as the Lucid and noble *Aer* clarifies the Blood, subtilizes and exites it, cheering the Spitirs and promoting digestion ; so the dark and grosse (on the contrary) perturbs the Body, prohibits necessary Transpiration for the resolution and dissipation of ill Vapours, even to disturbance of the very Rational faculties, which the purer *Aer* does so far illuminate, as to have rendered som Men healthy and wise, even to Miracle. And therefore the Empoysoning of *Aer*, was ever esteemed no lesse fatall then the poysoning of Water or Meate itself, and forborn even amongst *Barbarians*, since (as is said) such Infections become more apt to insinuate themselves and betray the very Spirits, to which they have so neer a cognation. Som *Aers* we know are held to be *Alexipharmac*, and even deleterious to Poyson itself, as 'tis reported of that of Ireland : In some we finde *Carcasses* will hardly putrifie, in other again rot and fall to pieces immediately.

Now whether those who were the Antient *Founders* of our goodly *Metropolis*, had considered these particulars (Though long before *Vitruvius*) I can no waies doubt or make question of; since having respect to the nobleness of the situation of *London*, we shall every way finde it to have been consulted with all imaginable Advantages, not onely in relation to Profit but to Health and Pleasure.

But I will infer, that if this goody City justly challenges what is her due, and merits all that can be said to reinforce her Praises, and give her *Title* ; she is to be relieved from that which darkens and eclipses all her other Attributes. And what is all this, but that Hellish and dismall Cloud of SEA-COALE ? which is not onely perpetually imminent over her head ; but so universally mixed with the otherwise wholesome and excellent *Aer*, that her *Inhabitants* breathe nothing but an impure and thick Mist, accompanied with a fuliginous and filthy vapour, which renders them obnoxious to a thousand inconveniences, corrupting the *Lungs*, and disordering the entire habits of their Bodies ; so that *Catarrhs*, *Phthisicks*, *Coughs* and *Consumptions*, rage more in this one City than in the whole earth besides.

What we doe here so much declaim against, since this is certain, that of all the common and familiar materials which emit it, the immoderate use of, and indulgence to *Sea-coale* alone in the City of *London*, exposes it to one of the fowlest Inconveniences and reproaches, than possible befall so noble, and otherwise incomparable City : And that, not from the *Cullinary* fires, which from being weak, and lesse often fed below, is with such ease dispelled and scattered above, as it is hardly at all discernible, but from some few particular Tunnells and Issues, belonging only to *Brewers*, *Diers*, *Lime-burners*, *Salt* and *Sope-boylers*, and some other private Trades, *One* of whose *Spiracles* alone, does manifestly infect the *Aer*, more than all the Chimnies of *London* put together besides. And that this is not the least *Hyperbolic*, let the best Judges decide it, which I take to be our senses : Whilst these are belching it forth their sooty jaws, the City of *London* resembles the face rather of *Mount Atna*, the *Court of Vulcan*, *Stromboli*, or the Suburbs of *Hell*, than an Assembly of Rational Creatures, and the Imperial seat of our incomparable *Monarch*. For when in all other places the *Aer* is most serene and Pure, and it is Ecclipsed with such a Cloud of Sulphure, as the Sun itself, which gives day to all the world besides, is hardly able to penetrate and impart it here ; and the weary *Traveller*, at many Miles distance, sooner smells, than sees the City to which he repairs. This is that pernicious Smoake which fullyes all her Glory, superinducing a sooty crust or Fur upon all that it lights, spoyling the moveables, tarnishing the Plate, Gildings and Furniture, and corroding the very Iron-bars and hardest Stones with those piercing and acrimonious Spirits which accompany its Sulphure ; and executing more in one year, than exposed to the pure *Aer* of the Country it could effect in some hundreds.

It is this horrid Smoake which obscures our Churches, and makes our Palaces look old, which fouls our Clothes, and corrupts the Waters, so as the very Rain, and

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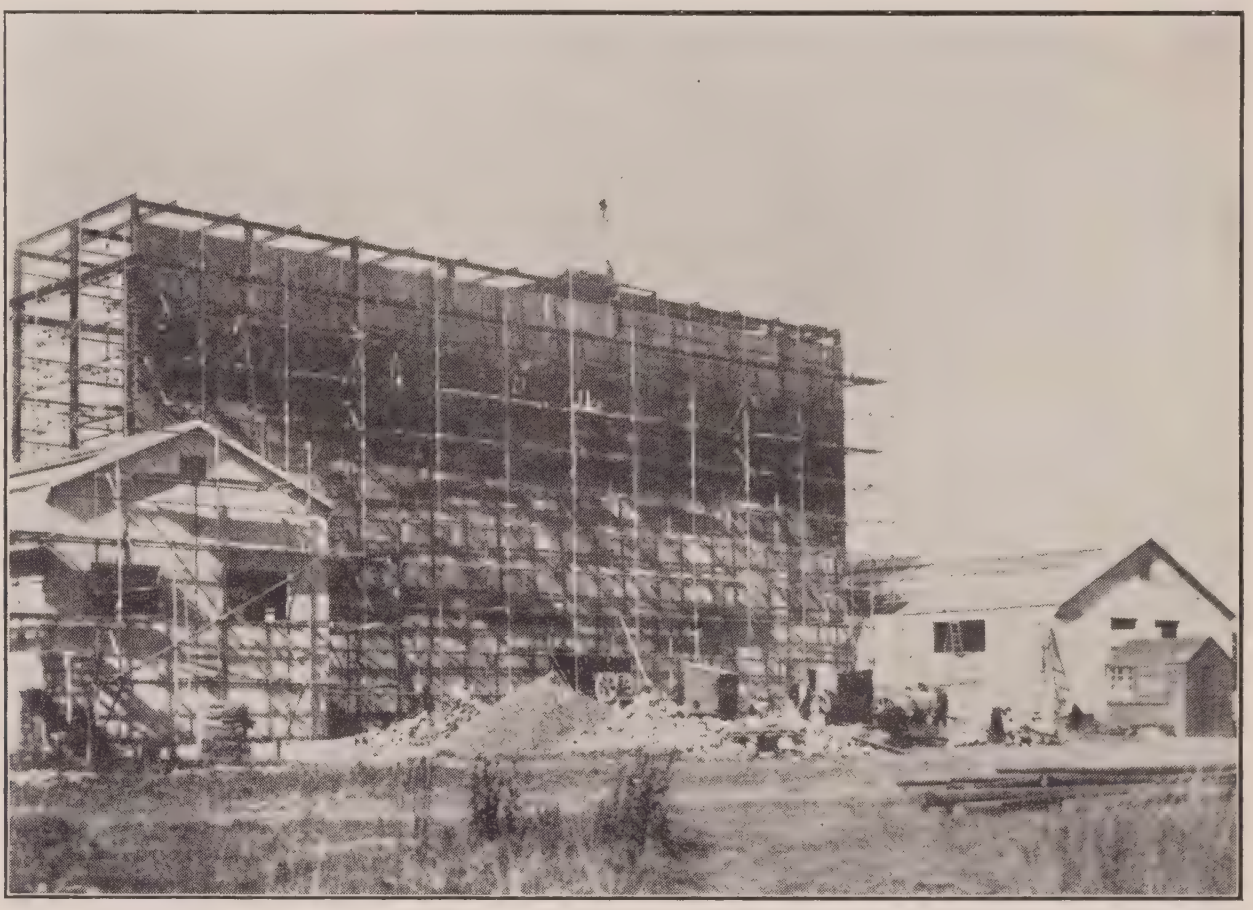

The greater part of this factory will be kept at a temperature of 160° F but the walls and roofs are only $3\frac{1}{2}''$ thick because they are made of THATCHBOARD. It is such an excellent insulator, however, that this factory will require only half the heating plant of one constructed of brick.

THIS MEANS THAT BY THE USE OF THATCHBOARD HALF THE SMOKE HAS BEEN ELIMINATED. If similar construction were extended to all new buildings the smoke problem would be largely Solved.

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refreshing Dews which fall in the several Seasons, precipitate this impure vapour, which, with its black and tenacious quality, spots and contaminates whatever is exposed to it.

It is this which scatters and strews about those black and smutty *Atomes* upon all things where it comes, insinuating itself into our very secret *Cabinets*, and most precious *Repositories*: Finally, it is this which diffuses and spreads a Yellownesse upon our choycest Pictures and Hangings: which does this mischief at home is *Avernus* to *Fowl*, and kills our *Bees* and *Flowers* abroad, suffering nothing in our Gardens to bud, display themselves, or ripen; so as our *Anemonies* and many other choycest Flowers, will by no Industry be made to blow in *London*, or the Precincts of it, unlesse they be raised on a *Hot-bed*, and governed with extraordinary Artifice to accelerate their springing; imparting a bitter and ungrateful Tast to those few wretched Fruits, which never arriving to their desired maturity, seem, like the *Apples of Sodome*, to fall even to dust, when they are but touched.

Not therefore to be forgotten, is that which was by many observed that in the year when *Newcastle* was beseiged and blocked up in our late Wars, so as through the great Dearth and Scarcity of Coales, those fumous Works many of them were either left off, or spent but few Coales in comparison to what they now use: Divers Gardens and Orchards, planted even in the very heart of *London*, (as in particuler my Lord Marquesse of *Hertford's* in the *Strand*, my Lord Bridgewater's and some others about *Barbican*) were observed to bear such plentiful and infinite quantities of Fruits, as they never produced that like either before or since, to their great astonishment: but it was by the Owners rightly imputed to the penury of Coales, and the little Smoake, which they took notice to infest that year: For there is a virtue in the *Aer*, to penetrate, alter, nourish, yea and to multiply Plants and Fruits, without which no vegetable could possibly thrive.

New Castle Coal, as an expert Physian affirms, causeth *Consumptions*, *Phthysicks*, and the Indisposition of the *Lungs*, not only by the suffocating aboundance of *Smoake*; but also by its *Virulency*.

The Consequences then of all this is, that (as was said) almost one half of them that perish in *London*, dye of *Phthisical* and *Pulmonic* distempers; that the *Inhabitants* are never free from *Coughs* and importunate *Rheumatisms* spitting of *Impostumated* and corrupt matter: for remedy whereof, there is none so infallible as that in time, the Patient change his *Aer*, and remove into the *Country*: Such as repair to *Paris* (where it is excellent) and other like places, perfectly recovering of their health; which is a demonstration sufficient to confirm what we have asserted, concerning the perniniousnesse of that about this City, produced only, from this exital and intollerable Accident.

To talk of serving this vast City (though *Paris* as great, be so supplied) with *Wood*, were madnesse.

But the *Remedy* which I would propose, has nothing in it of this difficulty, requiring only the Removal of such *Trades*, as are manifest *Nuisances* to the City, which, I would have placed at further distances; especially, such as in their Works and Fournaces use great quantities of Sea-Coale, the sole and only cause of those prodigious Clouds of *Smoake*: which so universally and so fatally infest the *Aer*, and would in no City of *Europe* be permitted, where Men had either respect to Health or Ornament.

For, (as we said) the *Cullinary* fires (and which *charking* would greatly reform) contributes little, or nothing in comparison to these foul mouthed Issues, and Curles of *Smoake*, which (as the Poet has it) do *Coelum subtexre fumo*, and draw a sable Curtain over Heaven.

Part III. of the book contains a delightful suggestion for still further improving the air of London, even when the smoke has been dispelled. This is possibly one of the earliest proposals of town-planning. It is, in brief, that there should be a wide belt around the city, in which should be planted all manner of sweet-smelling flowers—which are enumerated with loving precision—so that, no matter from which quarter came the wind, "the whole City would be sensible of the sweet and ravishing varieties of the perfumes, as well as of the most delightful and pleasant objects."

Our thanks are due to John Evelyn for his work. The three hundred years which have elapsed since he wrote it, have seen the greatest and most rapid advance of civilisation that has ever been known; they have witnessed the triumph of many reforms and the sweeping away of a multitude of evils; yet they have also permitted the smoke evil to grow and intensify to a degree that Evelyn could never have imagined. How many generations more must elapse before we can obtain this long sought-for "lucid and noble Aer?"

Paddington Borough Council are urging the London County Council to make a byelaw under the 1926 Act, prescribing a three minute limit in the half-hour for black smoke emission.

The Brighton Corporation electricity generating station is alleged to be causing a serious grit nuisance in the vicinity, and the matter has been taken up by the neighbouring urban district council of Southwick. It was stated by the Sanitary Inspector that in a nearby school the grit could be seen in heaps in the playground, and that the children were frequently denied the use of the playground for games and drill because of the danger to the eyes.

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A SMOKELESS "METRO" COKE FIRE

Farnworth and the Manchester Corporation

The Barton Power Station Case.

"*The aspects of this case bring up a question of the widest importance, and it would be well indeed if it could be brought home to those who in the future are in the position which enables them to settle and control the position of great electrical stations .... I do hope this case may attract public attention, for assuredly the dangers it discloses are a matter of great importance to thousands of people.*"—Lord Dunedin's Judgment in the House of Lords.

Mr. Arthur Farnworth farmed, and perhaps still endeavours to farm, land at Barton-upon-Irwell, a semi-rural locality some few miles west of Manchester. Shortly before the War the Electricity Department of the Manchester Corporation selected close to Mr. Farnworth's land a site of 12¼ acres for the erection of a new Power Station. The necessary statutory power to erect this Station and to lay cable lines connecting it with the supply area of the Corporation was obtained by the Manchester Corporation Act 1914, which was what is known as an "omnibus" act, giving powers for a variety of purposes. The War intervened and the Barton Power Station, erected in accordance with plans approved by the Electricity Commissioners appointed under the Electricity Supply Act 1919, commenced operation in 1924. The Station was then the largest, and is admittedly one of the most efficient in the Country; in fact, Lord Dunedin in giving Judgment spoke of it as "planned with callous indifference to everything but its own efficiency." To be quite fair, the evidence shows that, taking a lesson from complaints as to dirt and grit given off by their existing station in Stuart Street, the Corporation did put in Grit Extractors at Barton, which the Contractors guaranteed to take as much as 90% of the grit from the gases emitted. The indifference, as often happens with a Corporation, was not so much to complaints already voiced as to effects which ought to have been anticipated. The new station, fitted with mechanical draught and low steel chimneys, began to burn daily 500 tons of soft Lancashire Coal with a sulphur content of 2.2%, no apparatus for eliminating which was installed; consequently the fumes emitted each day contained some 11 tons of sulphur in the form of sulphur dioxide, turning to acid on contact with moisture, which had to come to ground somewhere. Trouble soon began, and as early as May, 1925, the chief Engineer of the Corporation's Electricity Department reported that several complaints had been received from tenant farmers in the vicinity alleging damage to crops from the fumes, and stated that by way of experiment an extra 20 ft. was being added to the height of the chimneys. Another 20 ft. (making a total height of 161 ft. 5⅞ inches) was added in 1926. Apparently no improvement followed, and on October 26th, 1926, Mr. Farnworth, backed by the National Farmers' Union, issued his Writ claiming damages against the Corporation and an injunction to restrain the Corporation from causing to issue from the Station "offensive, noxious, poisonous and unwholesome and deleterious smoke, fumes, vapours, gases, soot, black noxious dirty and filthy matter." The Corporation by their defence denied the acts complained of or that such acts created any nuisance to the Plaintiff's farm, but added that, if the acts complained of had been done, they had been done by the Corporaton in pursuance of powers conferred by the Manchester Corporation Act 1914.

The case was tried before Mr. Justice Talbot, without a Jury, at the Manchester Assizes on the 27th day of May, 1929, the Plaintiff being represented by Mr. Singleton, K.C., and Mr. Neville Laski, and the Corporation by Dr. Cyril Atkinson, K.C., and Mr. S. G. Turner. After two witnesses had been called on behalf of the Plaintiff the Corporation admitted the nuisance complained of—"we have necessarily materially added to the discomfort of the area." The defence therefore fell back on the argument that, having obtained statutory power to erect the Station, the Corporation could not be held liable for the necessary consequences of working it. To this the Plaintiff replied in the first place that under the Electric Lighting (Clauses) Act 1899 there is implied in each "special Act" or act authorising the supply of electricity within any area, a "nuisance clause" to the effect that the statutory powers shall not exempt the suppliers of electricity from ordinary liability for nuisance. The Manchester Corporation Act 1914 it was argued, was a "special Act" for that purpose. Much of the hearing both at the Assizes, and afterwards before the Court of Appeal and the House of Lords, was occupied with this argument which would have disposed of the case in the Plaintiff's favour, and on both appeals there was a difference of opinion among the judges. The argument failed, however, principally on the very technical ground that the Act of 1914 though authorising the Corporation (among other things) to erect a power station and lay cables, did not thereby authorise the "supply of Electricity within any area."

In the next place the Plaintiff argued, that if the Corporation are to be free from liability for the consequences of working the station they must at least be able to show that such consequences are necessary. The further evidence called was mainly directed to satisfying the Court that the Corporation had done all that could reasonably be required in the matter, having regard to existing means of prevention, the mischief occasioned being inseparable from the production of electricity on so large a scale. The Assize Judge decided both points in favour of the Corporation, but

Wipe out that smoke !

" Scientific methods of coal consumption would not only abate the nuisance and promote health and the amenity of life, but would be economical in industry. The emission of black smoke from chimneys serving boilers only is unnecessary and reprehensible."

The above is taken from a paper read before the Royal Sanitary Institute by Professor Wynne, M.B., D.P.H., Medical Officer of Sheffield, a full report appears in the current issue of *Cheap Steam*, published by Edward Bennis & Co. Ltd., a copy of which will be gladly sent on application.

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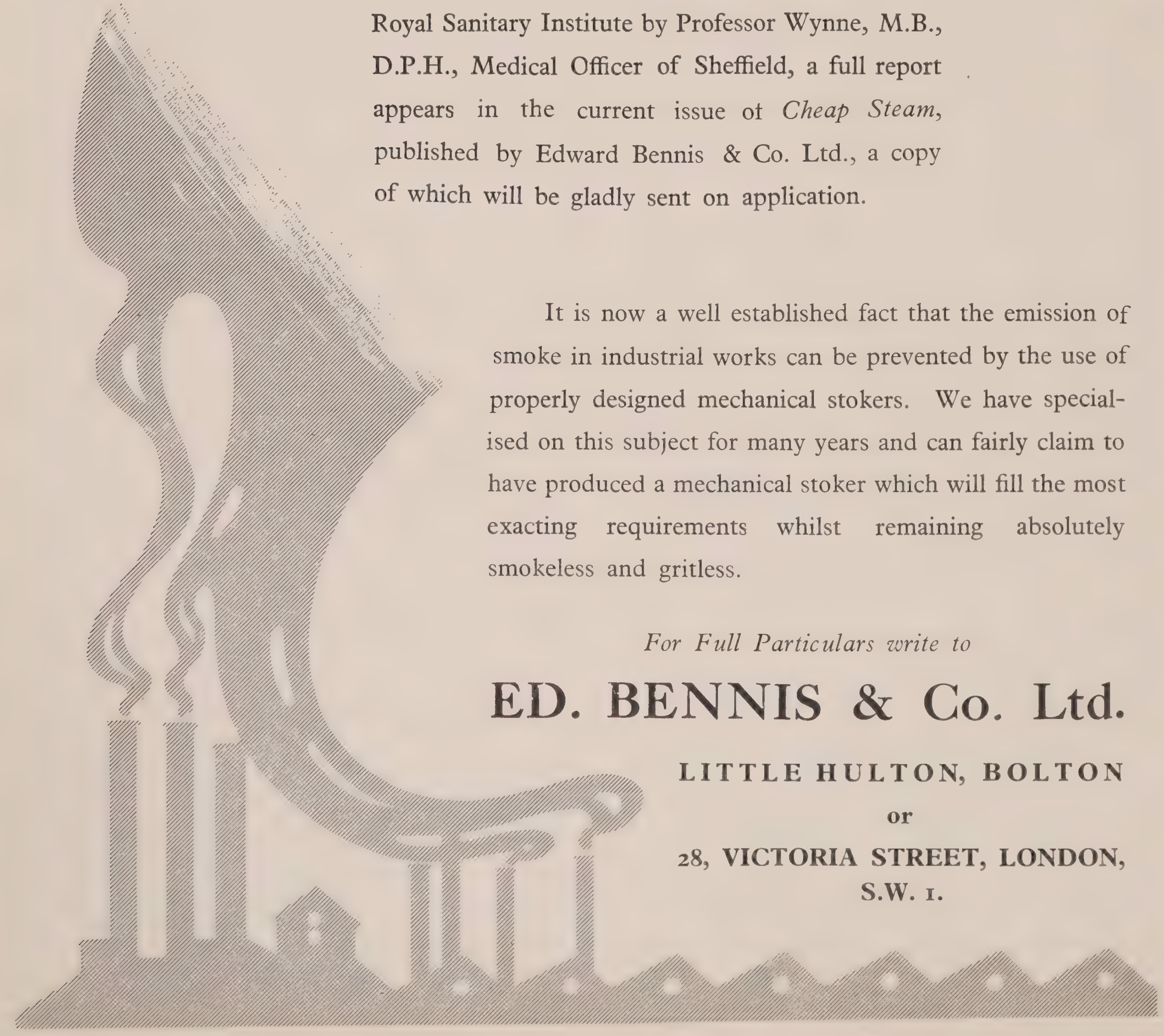

as the Corporation had been forced to admit the nuisance, did not order costs against the Plaintiff. The Plaintiff appealed.

The Court of Appeal, Lords Justices Scrutton, Lawrence, and Sankey, by a majority decided in favour of Mr. Farnworth, on the ground that no satisfactory evidence had been given that the Corporation had taken reasonable precautions to prevent the nuisance, or maintained and worked the Station without negligence.

The Corporation then appealed to the House of Lords. This appeal was heard before Lords Dunedin, Sumner and Blanesburgh, who gave judgment on the 28th day of December, 1929, dismissing the Corporation's appeal, and making an order in favour of Mr. Farnworth for damages and an injunction against the Corporation. The operation of the injunction "to restrain the Defendants from committing a nuisance by their Generating Station and fumes therefrom causing damage to the Plaintiff's land," was, however, suspended for a year from the date of the Order, the Corporation being given liberty to apply to the Court to have the injunction removed (*a*) on their establishing that they have exhausted all reasonable modes of preventing mischief to the Plaintiff and (*b*) on their submitting in the future conduct of the Power Station to adopt and use the most effective of these modes until replaced by other reasonable but more effective modes of prevention which may thereafter be discovered, and which will thereafter be adopted and used. Lord Dunedin referring to the evidence declared that it had been clearly proved that those responsible for the design and working of the Station never considered when designing the effect it would have on the neighbourhood and never asked or obtained outside advice from those skilled in such matters. Had the Corporation been under a nuisance clause they would have really exerted themselves to find a remedy. Similarly Lord Sumner, after an exhaustive review of the evidence, came to the conclusion that the Corporation had never put themselves in a position to say that a nuisance by sulphur was necessarily incidental to the emission of the fumes nor that prevention was only possible by some extraordinary means or at the price of defeating the enterprise which the statute authorised.

The case is interesting, as it clearly indicates that whatever may be the shortcomings of inferior Magistrates, the higher judicial authorities are zealous to protect the right of the public to an unpolluted atmosphere. It will also be proved, we may hope, that in the matter of the prevention of atmospheric pollution as in other matters "necessity is the mother of invention."

C.G

The Manchester Smoke Abatement Exhibition

The Manchester Exhibition which commenced, rather appropriately, on November 5th, was a marked success from the point of view of both exhibitor and visitor. The City Hall was well filled by stands at which were shown smokeless fuels and appliances of every kind, both industrial and domestic. Large portions of the space had been taken by the Gas and Electricity industries, and as these had been arranged by the co-operation of the various undertakings in the area, it was possible for elaborate and comprehensive exhibits to be arranged. Many forms of mechanical stokers, smoke preventing furnaces and appliances and other material of interest to the industrialist were shown, including a Wollaston producer boiler working during the entire fortnight.

On the domestic side, in addition to the numerous applications of gas and electricity which were demonstrated, the various solid smokeless fuels were to be found burning brightly at their respective stands. There was anthracite and gas coke, and the low temperature carbonisation fuels were represented by "Ricoal" and "Coalite."

The Society's stand contained many photographs and diagrams illustrating the smoke nuisance, together with a new exhibit which illustrated, panorama-like, the effects of smoke from beginning to end. There was, of course, a large and varied selection of the Society's publications and other literature. The Health side of the question was stressed by the excellent stands of the Manchester Public Health Department and the National Association for the Prevention of Tuberculosis. Great interest was aroused at the former by rhododendron bushes from Manchester and from the neighbouring countryside, and also by actual specimens of the human lung.

During the course of the Exhibition various lectures were given, the lecturers including Sir Alfred Cope, Mr. H. L. Pirie, Mr. R. H. Clayton, Mr. Alderman Melland, the Chairman of the Society, and its Secretary, Mr. Marsh. Visits were paid by, and lectures given to, the Manchester District Section of the Institution of Gas Engineers and the Electrical Association for Women.

The exhibition was held under the auspices of the Society, and was organised by Provincial Exhibitions, Ltd., while the Manchester *Daily Dispatch* gave valuable publicity.

The opinion was frequently expressed that it was a "good show" because every exhibit had direct connection with the subject, and that therefore every stand was of interest and value. This is a tribute to the excellent arrangements of the organisers; to whom our best thanks are due for enabling Manchester and the north in general to see, in full detail, and by many methods, what is being done to overcome the smoke evil.

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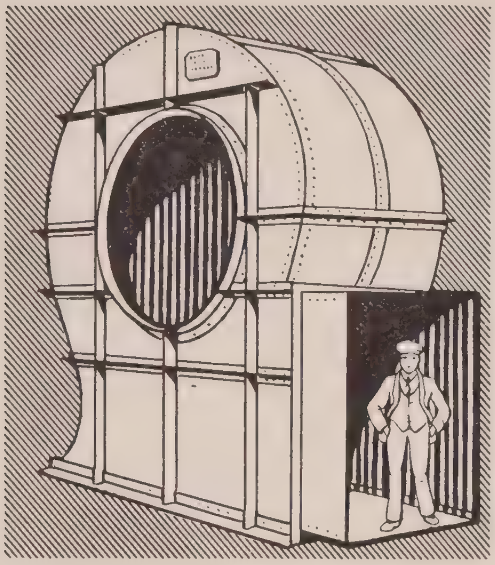

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Smoke Abatement and Fuel Ecomony in Steam Boiler Practice. Manchester and District Regional Smoke Abatement Committee, Civic Buildings, Manchester. Pp. 11. 1d. or 5/- per 100.

This useful pamphlet has been prepared by three experienced members of the Regional Committee and is intended to interest the manufacturer himself. The causes of black smoke are tabulated and the chief factors in promoting plant efficiency are dealt with one by one, with brief notes upon each. In addition to the customary injunctions for the correct working of a boiler plant (but which will doubtless be novel to some steam users,) there is stressed the necessity of taking full precautions in selecting suitable fuel ; the value of co-operation between steam-raising and steam using departments ; and the importance of keeping a record of the boiler performances by means of draft gauges, CO_2 testing apparatus and thermometers and pyrometers for water and gas temperatures. The pamphlet is further increased in value by the reproduction of the F.B.I. diagram illustrating the frequent sources of heat wastage in boilers.

Successful Stoking and Smoke Abatement, by Ernest Dickinson. (Clitheldor, Sandal, Wakefield). Pp. 53. 2/-.

This book is described as a manual for boiler attendants, and while it will be of value to those who are studying the subject with a view to taking a certificate or otherwise aiming at proficiency, one can hardly hope that it will be read by the many fireman who are content to work by rule of thumb. The chapter on boiler house instruments is mainly written for the engineer and discusses with him the fireman and his training. On a minor point, the abbreviation B.T.U. (Board of Trade Unit) should not be used when British Thermal Unit, (B.Th.U.) is required. This is mentioned merely because the error is becoming rather too frequent, and is apt to lead to confusion.

Fuel Economy Review. Vol.VIII., 1929. Issued by the Federation of British Industries, 39, St. James's Street, London, S.W.1. Pp. 90 vi. 2/6.

Anyone interested in smoke abatement must necessarily be interested in fuel economy, for the whole problem of smoke is dependent upon the economic use of fuel. The Fuel Economy Review rather overwhelms one with the variety of its topics and the standing of its contributors, while practically every page is directly connected with some aspect of smoke abatement. The Industrial Uses of Town's Gas, Thermal Storage in Connection with Steam Raising Plant, Low Temperature Carbonisation, the Hydrogenation of Coal, among many other articles, deal with vital points in authoritative fashion, while Mr. H. G. Clinch contributes an article on " Smoke, the manufacturer and the Health Authority," which in addition to being an explicit consideration of many of the problems which have to be faced in the relationship of the local authority and the manufacturer, contains much of his own wide experience. It may be suggested that amid such a wealth of material, an index would be of considerable value.

"Anti-Smoke" Slogans

" Though no public Appeal has been issued, I understand that the National Smoke Abatement Society would welcome with feverish gratitude a new and brighter slogan with which to carry on their public-spirited work. Whoever undertakes to satisfy this mute appeal must recognise that ingenuity will have to be its own reward—no gold cups, fat cheques or 1930-model motor-cars will come his way, however brightly burns his genius. Please note too, that the following slogans have already been adjudged impracticable, if not worse. Do not imititate them.

" Anti-Smoke is no Choke " is one effort sent in by a gentleman from Wales, with a covering letter full of " Whateffers " and " howeffers," but containing no enlightenment on the important subject of the slogan itself and what it might possibly mean. I beleive the gentleman has been advised to try again in about five years' time.

Filial anxiety of a perfectly natural kind was responsible for the slogan " Smoke and Smother's Bad for Mother." Unfortunately, however, the purely sectional appeal of this excellent phrase reluctantly ensured its rejection. The Smoke Abatement Society have ot take into consideration, not only mothers, but sisters and brothers and cousins and aunts.

Political reasons led to the rejection of the slogan " Be British and Banish Smuts," an erudite member of the Society pointing out that such a slogan, repeated, as it would be, on thousands of hoardings throughout the country, would inevitably lead to a coolness in our relations with South Africa and one of her prominent statesmen. The sender was, however, exonerated from all political motives. " Black Smoke Makes Blackshirts " was declined for a similar reason, as disrespectful to a sister nation, though an honest statement of fact."

The imaginative " C.J.A." of the " *Daily News*," who penned the above was evidently not in full possession of the facts of a real discussion in the subjest at Buxton in October, or surely he would have included the suggestion from Newcastle, " Be ye like Leicester." The proposal was not, however, very keenly supported.

A Survey of the Smoke Problem

A LECTURE COURSE IN MANCHESTER

A course of six lectures on the smoke problem was held in the College of Technology, Manchester, from November 8th to December 13th, 1929, in which every aspect of the question was considered by different speakers. The lectures, arranged jointly by the Society, the Manchester and District Regional Committee, and the Fuel Department of the College, were of an educational nature and were especially intended for those who are taking an active part in some phase of the work. Summaries of the lectures are given below :—

Coal and its Combustion.

By A. McCulloch, M.Sc. Tech., A.I.C. Lecturer in Fuels in the University and Head of the Fuel Department, College of Technology, Manchester.

The paper dealt briefly with the formation of coal, its composition and constituent bodies, showing that coal is far from a homogeneous material. The division of coal, by visual examination, into fusain, durain, clarain and vitrain was described. A rational system of classifying coal would be based upon such considerations of composition. Coals used for steam-raising should be free-burning and only slightly coking. The ideal coals for this purpose from the smoke abatement point of view are the South Wales smokeless steam coals, but with carefully controlled plant of sufficient capacity and an intelligent personnel operating that plant, practically the whole range of the so-called bituminous coals can be used satisfactorily. In coke oven work the character of the coke is all-important, and this is dependent on the coal used and in gas manufacture the yield of gas and by-products as well as the quality of the coke has to be considered.

The combustion of coal, as for example, in the open domestic grate, falls into definite stages. On the top of the fire the fresh coal is undergoing a process of progressive distillation ; following upon this zone is a further one in which the coke produced by the distillation in the preceding zone is combining with gases in a still lower zone, and with any available air ; then follows a zone in which the coke which has survived the second zone is actually being burnt to ash, and finally we have a zone of ash which rests upon the bars of the grate.

The zones are not always sharply defined but can be clearly distinguished in a thick fire. It is the uppermost layers of the fire, or the distillation zone that smoke is produced. Fresh coal is largely heated by the gases passing upwards through the underlying layers, and is thus slowly carbonised at a comparatively low temperature. Active combustion does not commence until the temperature of the coal rises above 400C. The formation of smoke therefore, is due to the presence in the coal of bodies which decompose before that temperature, giving rise to volatile bodies, which, owing to their high carbon content, are not easily and completely burnt at the low temperature obtaining in this zone.

Smoke and Health, by J. S. Taylor, M.D., D.P.H., Assistant Medical Officer of Health, Manchester.

The impurity of the atmosphere is indicated by the fact that in Manchester 20,000 tons of solid matter fall annually, containind 75,000 gallons of tar and a quarter of a million gallons of acids.

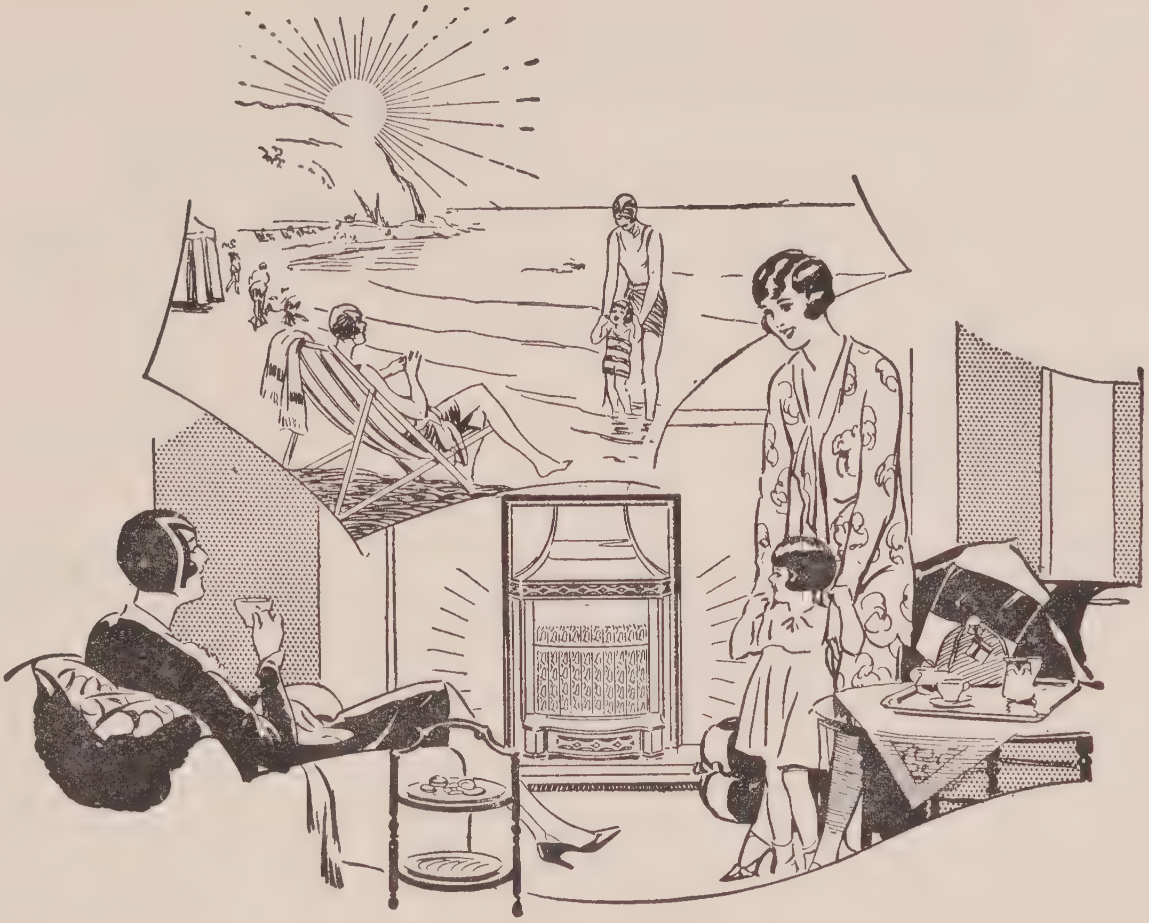
The result of breathing air so badly polluted on the lungs is chronic irritation of the bronchi, a susceptibility to bacterial invasion, deposition of soot in the lung tissue with resulting catarrh, bronchitis, emphysema and cardiac failure. As the heart has to do double the work in forcing the air through the now resisting lungs, the effect upon it is necessarily harmful. Such is the air we breathe and we inhale about 35lbs. of it daily. It is rather extraordinary that while we have so much legislation regarding food and water, legislation for air should be so long delayed, and yet we consume seven times as much air by weight per day as we do food and water combined. After a fog in which the impurities are concentrated in the lower layers of the atmosphere there is a considerable increase in the death rate from respiratory diseases.

It is a well-known fact that tars and oils produce cancers, e.g., in shale oil industry, in mule spinning and many other industries. The researches of Professor Shaw Dunn and Mr. Duguid support the view that there is appreciably greater incidence of cancer in the thorax in places where the atmosphere is smoke laden.

A further effect of the smoke laden atmosphere is to cut off solar radiation, both visible and those of even greater biological interest, the ultra-violet rays. These latter are lethal to bacteria, prevent the onset of and are curative of rickets ; are beneficial in treatment of certain skin diseases ; are of great value in the treatment of surgical tuberculosis ; increase the power of one's blood to resist bacterial attacks and are an excellent tonic.

It has been shown that some of the congested areas in Manchester receive less than 40% of the daylight which they should get.

The effect on vegetation of air pollution is very marked. Soot is deposited on the foliage, stopping up the pores, acids burn and kill the tender leaves and shoots and the deposited soot on the soil hinders free passage of air to the roots.



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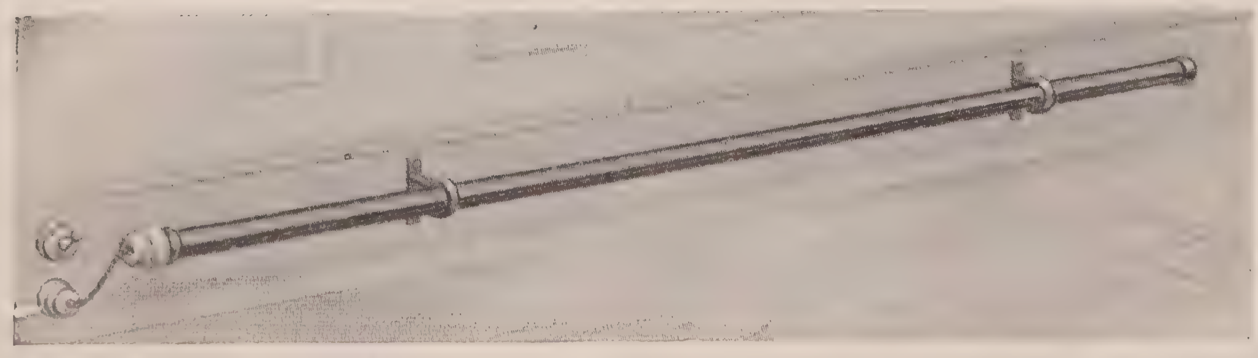

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In Manchester the prevailing winds blow from the South West, and on the south side of the city vegetation is fairly normal, e.g., the pine will grow there successfully, but on the north side it cannot be cultivated. At Phillips Park, which is almost surrounded by large industrial works each year to keep it in a presentable condition there are planted 2500 Rhododendrons, 2500 Poplar trees, 1000Willows, 750 Alders and 300 kinds of flowering shrubs.

Smokeless Fuels, by William Gibson, M.Sc.Tech. A.I.C.

Smokeless Fuels may be classified under four headings Solid, Liquid, and Gaseous Fuels, and Electricity. The lecturer dealt in greatest detail with the first class, but considered points of interest in the others before doing so. The value of the thermal basis of the sale of gas was dealt with. In up-to-date gas manufacture saleable coke represents about 45%, and saleable gas 25% of the thermal value of the coal carbonised. In large modern stations the thermal efficiency of the generation of electricity from coal is about 20%. In general the cost of manufactured gas on a thermal basis is much larger than that of coal ; the cost of electricity much higher than that of gas. On the other hand, electrical appliances usually give relatively high efficiencies in use, and solid fuel appliances relatively low efficiences. As regards oil, while it is not used to a great extent in this country for domestic heating, a great industry has recently sprung up in America for the burning of kerosene and "furnace oils" for domestic heating. The term "oil burner" now signifies an automatic device, controlled by a thermostat, which keeps the householder warm, and relegates his coal shovel to the scrap-heap. As any automatic device in the hands of unskilled users is subject to breakdown and stoppage, the most successful makers of domestic oil burners in America have established efficient service departments.

Anthracite, gas coke and low temperature carbonisation fuels were considered at length. The different methods of producing coke were sketched, and the desirable features of such a fuel reviewed. The continuous vertical retort gives a coke which when supplied in a dry condition and suitably graded will burn in open fires as well as closed stoves. It also possesses a higher calorific value than that from horizontal or inclined retorts. Static methods give a denser coke, but with modification of existing practice or by suitably blending with non-coking coals, a product may be obtained which will command a higher price and will light with ease in the open grate.

The different types of semi-coke were considered and a review given of low temperature carbonisation progress in this country. There are now 24 plants treating more than 25 tons of coal per day, now actually operating or under construction. A dozen more are of experimental size and others are projected.

The Abatement of Domestic Smoke.

By Miss Marion Fitzgerald, A.R.San.I.

The lecturer first considered the nature, amount and importance of domestic smoke, and pointed out that it was not possible to estimate the relative amounts of domestic and industrial smoke as it varied from place to place and according to the season of the year. It was probable that domestic smoke is less in quantity but worse in quality, and that factory smoke plays the greater part in darkening the air.

The aim is to reduce the consumption of raw coal in domestic grates to the smallest possible amount. In recommending substitutes we must pay attention to both the economic and the aesthetic aspects. It is also of importance when considering costs to distinguish between long period and short period heating, as well as the actual efficiency of the various mediums, varying from 100% with electricity to 20% with coal.

The low temperature fuels possess the great psychological advantage that they enable us to retain the open fire, as well as giving a hotter fire. The main difficulty is that these fuels are not yet freely available, although great improvements are being made. Further, when the price is higher than coal it is difficult to convince people that such a fuel can be more economical in the long run. Anthracite is not everybody's choice, but for a certain type of household it can be used to very great advantage. Anthracite ranges will perform all cooking operations, heat the domestic hot water supply and two or three radiators as well. The open anthracite fire, designed by Dr. Owens, can now be obtained. Gas coke is a most useful fuel when intelligently used, and also gives satisfaction for boilers used for central heating—which is the cheapest and most efficient way of heating a house, especially when supplemented by radiators or open fires to give the physiologically necessary radiant heat. Gas coke can be burnt in many open grates but requires attention and replenishment before it burns too low. Gas and electricity are fortunately more easily obtained and are cheapest in the thickly populated areas where they are most needed. While relatively dearer than solid fuels great savings can be effected which offset their cost. Gas works out more cheaply, besides being more convenient than coal for short period use, and even electricity may be economical for certain types of households—as where it may save the cost of paying, housing and feeding a resident maid.

Where coal has still to be used it is possible to obtain a hotter fire and diminish the amount of smoke by mixing the coal with coke. While the outlook for domestic smoke abatement is improving but slowly at the moment, developments may be quicker in the near future. We must depend upon good citizenship combined with an enlightened self-interest leading to the adoption of smokeless methods when and where possible.

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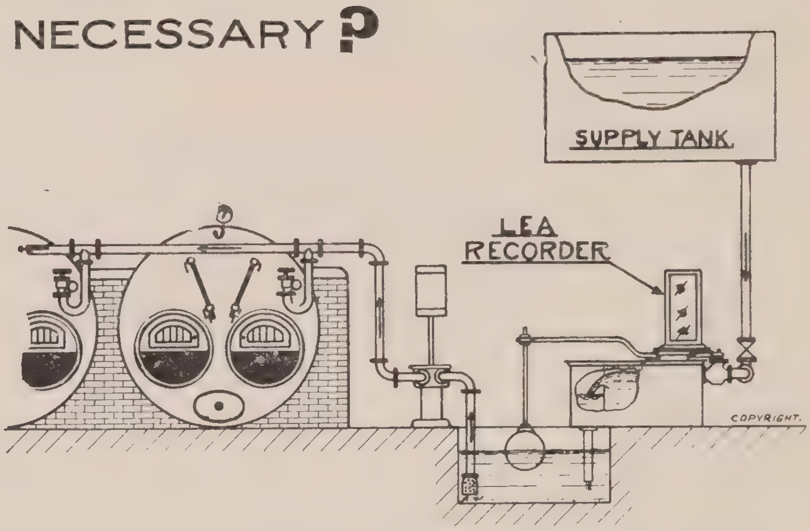

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The Abatement of Industrial Smoke.

By R. M. Rowe.

The difficulty of dealing with industrial smoke was dealt with, and would be lecturers advised to treat it in a very general manner unless they had technical experience.

Industrial smoke accounted for 50% of the nuisance, and 90% of this was due to boiler furnaces.

The principles of combustion were dealt with, and the cases of gaseous, liquid, pulverised fuel and solid fuel considered—the object being to obtain the most intimate contact with the oxygen of the air, which was easiest with gaseous fuel and most difficult with solid. The effect of the dilution of the oxygen with inert gas was pointed out.

For steam raising the Lancashire boiler was the most common ; the water tube boiler largely was used for power stations, and fire tube for locomotive engines.

There was no royal road to smoke abatement. The conditions necessary might be summed up as : sufficient boiler plant ; perfect equipment and repair ; suitable fuel ; intelligent stoking and control, using the means science has provided for this purpose. By these means ecomony and smoke abatement would be attained. Black smoke meant careless and wasteful work. Section 74 of the report of the Departmental Committee of the Ministry of Health was quoted : "The evidence shows that under normal conditions, and with careful stoking, either mechanical or by hand, little or no smoke need be made from boiler furnaces."

Turning to the legal side of the question, the Public Health Act, 1875, was still the main weapon to deal with industrial smoke. The Act of 1926 had, if anything, a retrograde character in that it extended the exemption clause unnecessarily, and gave power to the Minister of Health to exempt any manufacturing process —a very dangerous provision.

Section 91, Subsection 7, Clause 2 P.H.A., 1875, remained the chief means of dealing with industrial smoke. "Any chimney not being the chimney of a private dwelling house sending forth black smoke in such quantity as to be a nuisance."

This clause was not affected by the new act. The clauses for its administration had been strengthened by the increase on the penalty obtainable from a magistrate's order to abate from £5 to £50, and the increase of the penalties for disobedience of the order from 10/- and 20/- per diem to 40/- and £5 per diem respectively.

The clause dealing with smoke other than black smoke would probably be as inoperative as the first clause of Subsection 7, and for a similar cause, as it was dependent upon a best practical means clause which would enable an effective defence on technical lines to be set up.

So far the clause (1926 Act) dealing with new buildings other than private dwellings, has not been used owing to the difficulty of framing suitable bye-laws. Bye-laws relating to black smoke have been sanctioned, but so far nothing relating to smoke other than black smoke has been approved.

The best point in the new act was the stimulus given to local authorities to deal with smoke nuisance.

The failure of local authorities to deal with smoke from steam wagons was explained as due to the wording of the Act relating thereto, the words "except from any temporary or accidental cause" proving a stumbling block to successful proceedings. The omission in the 1926 Act of any amendment of this unsatisfactory state of things is inexplicable.

Railway engines could be dealt with under the railway clauses of the Consolidation act and the Regulation of Railways Act, 1868.

General Aspects of the Smoke Problem.

By Arnold Marsh, M.Sc.Tech.

This lecture covered a very wide field in an endeavour to round off the subject as completely as possible. Atmospheric pollution as a science was first dealt with, giving an account of the natural ventilatory processes and the formation of fogs, followed by a sketch of the methods employed to measure the degree of pollution in the atmosphere. The question of sulphurous fumes from power stations was touched upon, with mention of the Barton case and the Battersea controversy. The London Power Company it was stated, have an experimental plant which absorbs 95% of the sulphur acids, by the use of water sprays, although it remains to be seen whether this success will be maintained on the larger scale.

From the economic aspect the effects of smoke upon vegetation, buildings and other property was dealt with, and led to a consideration of the cost of smoke. Figures largely based upon the Pittsburgh inquiry of 1912, and adjusted to the present level of prices, give an annual cost of £2 to each individual, or £80,000,000 to the country, which represents the interest upon a capital sum which is far in excess of the total external national debt.

Smoke was also condemned from as aesthetic point of view ; the accumulated darkness, drabness and dirt of our cities inevitably must have certain psychological effects upon the inhabitants, especially when coupled with the physical results of curtailed sunlight.

The situation abroad was considered at some length. In Germany regulations were more strict than in this country, and there existed many boiler associations for the benefit of steam-users. These coupled with the almost complete absence of domestic smoke led to conditions much better than in this country. Conditions varied from state to state in the U.S.A. In

Smoke and Disease

Smoke is perhaps the gravest danger to our national health.

Statistics show that about fifty per cent. of the time lost in workshops and offices in this country is caused by respiratory diseases due to the pollution of the atmosphere by smoke.

More than half the three-year-olds of this country have rickets, because they are robbed of sunlight by the smoke pall.

The amount of sunlight has been found, by readings taken from various parts of England, to be in inverse proportion to the degree of air pollution.

About seven-eighths of the sun's power is shut off by smoke from the centre of London, and eighty tons of poisonous soot are emitted in the capital every hour.

The remedy lies in the burning of the smokeless fuels, gas and gas coke. The atmosphere is not polluted in the slightest degree either during their manufacture or their actual combustion.

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some places, as in Salt Lake City, intensive campaigns had resulted in great improvements, but in others little or nothing had been done to combat the nuisance. In Boston, for instance, efforts were being made to form a smoke abatement association, while in Pittsburgh the Smoke Research Bureau at the Mellon Institute has recently been reopened. Renewed agitation is being carried out in New York, where it is estimated that there is sixty million dollars per annum property loss. The paper concluded by a discussion on the methods of smoke abatement propaganda, and of the factors to be considered in engaging upon any smoke abatement education.

A driver was charged at Amble Petty Sessions on December 13th, with unlawfully using a locomotive on the highway which did not consume its own smoke as far as practicable. He was fined 6/-.

By the end of the winter the Society will have exhibited or given lectures at Health Weeks, etc., at Oldham, St. Helens, Wolverhampton, Radcliffe, Swinton, Eccles, Hyde, Gateshead, Keighley, Middleton and Bolton. The Society is also represented in the travelling "Save the Countryside" exhibition.

In the Annual Report of the Salford Health Department, Dr. Osborne points out that there is a general improvement in the emission of black smoke from the works chimneys, but that as Salford is largely a working-class dormitory packed with small dwellings, it is necessary for people to stop burning raw fuel. Gas coke is still largely neglected as a domestic fuel, continues Dr. Osborne, yet a good dry gas-coke gives an ideal fire where the householder is sufficiently interested to learn how to use it.

"It is apparent that the economic loss from the smoke nuisance affects every field of human enterprise and endeavour. There is no group or organisation that is not interested in curing the evil."

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Descends as soot our lungs to choke,
And turns to night what should be day:
This murk that veils the healing ray.
When will a Wilberforce arise
And cleanse this poison from our skies?

F.R.

NOTICE

COMMENCING WITH THE NEXT ISSUE, THERE WILL BE AN ALTERATION IN THE TITLE OF THIS JOURNAL.

(See Note, Page 39).

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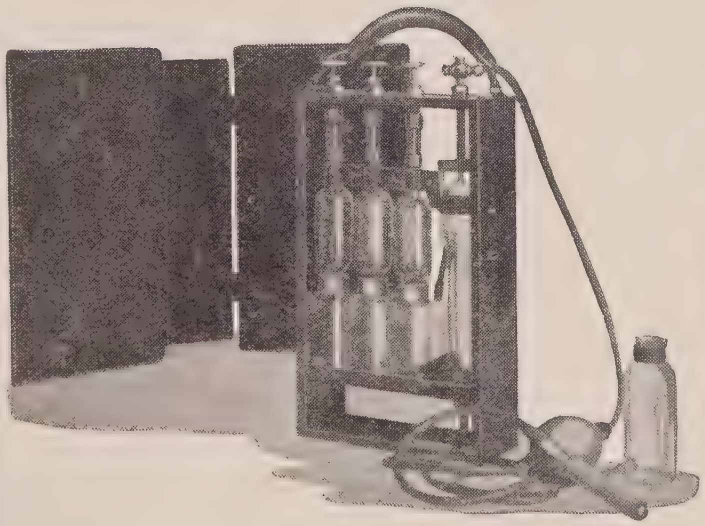

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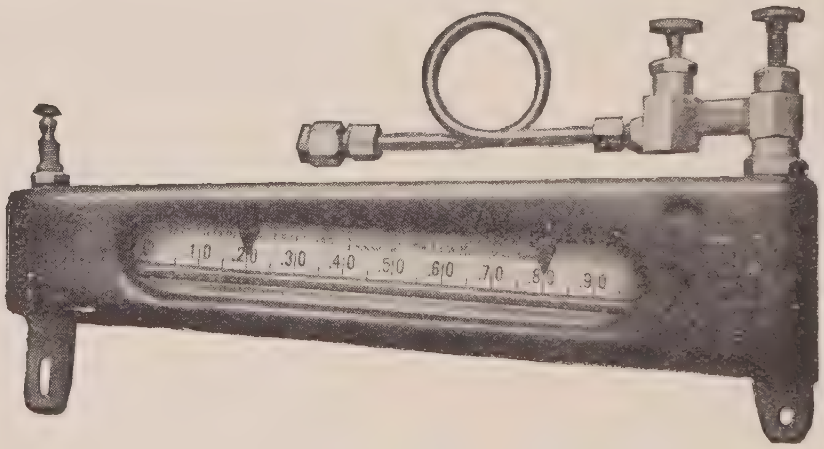

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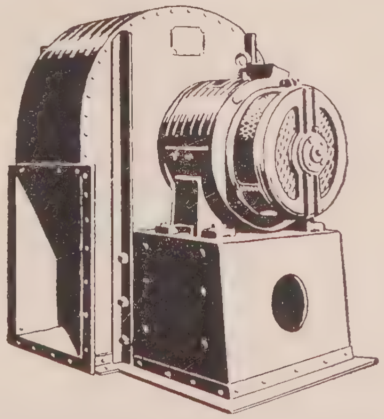

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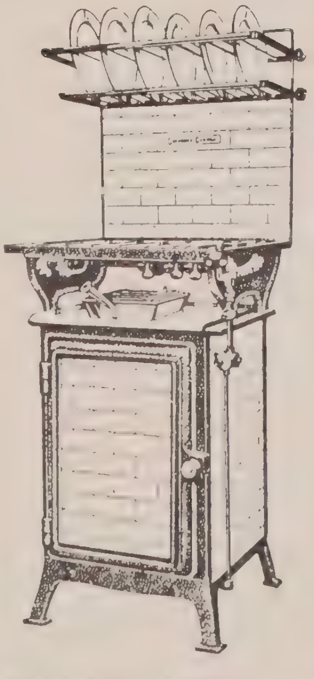

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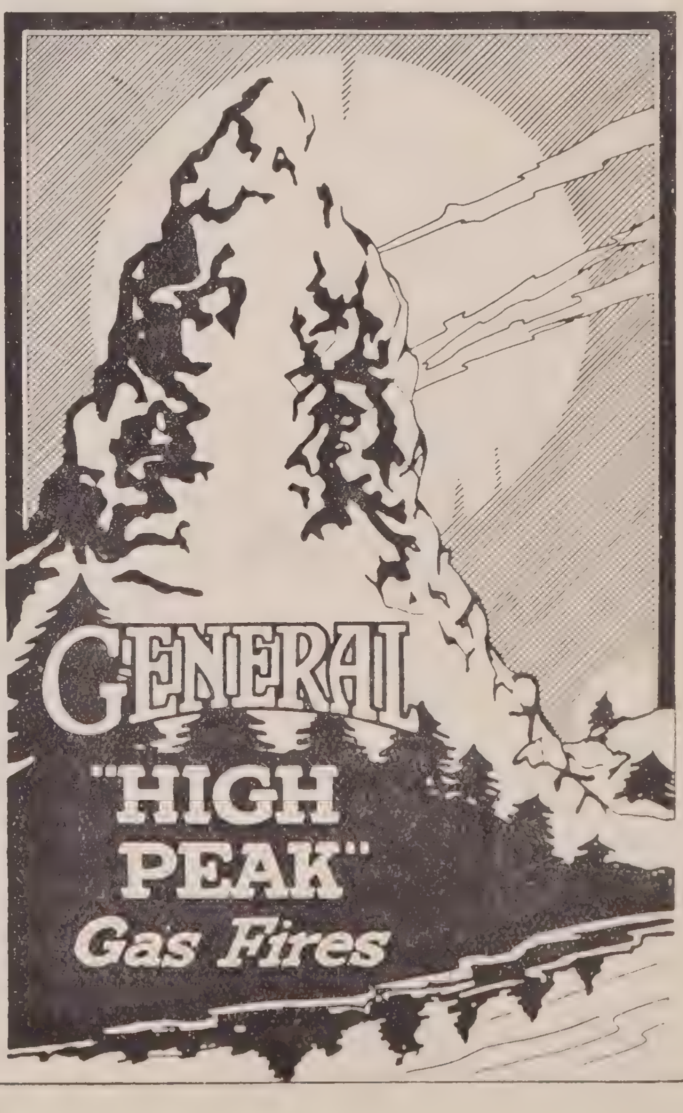

The Journal of the National Smoke Abatement Society

(The Official Quarterly Organ)

Editor : **Arnold Marsh, M.Sc.Tech.**

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CONTENTS OF SUMMER ISSUE

	Page
Commentary	71
Smoke Abatement in the U.S.A.	75
Where do we stand ? A Review of the Industrial Aspect	79
From the Municipalities and Branches ..	85
Current Events	89
The Investigation of Atmospheric Pollution ..	90
A Classical Experiment in Atmospheric Pollution	95
Byelaws under Section 5 of the 1926 Act : The London Conference	95

COMMENTARY

THE Conference which was held at 71, Eccleston Square, Westminster, on Friday the 2nd May proved most useful and interesting. A large number of representatives of the Society and of local authorities were present and the paper by Mr. Allpass, L.C.C., on the difficulties of making byelaws under Section 5 of the Public Health (Smoke Abatement) Act, 1926, proved to be an exceptionally valuable contribution to Smoke Abatement literature.

Mr. Allpass is the Chairman of the Public Control Committee of the London County Council and is therefore in a position to speak with authority. It came as a surprise to the meeting to hear that technical difficulties have hitherto prevented the making by local authorities of byelaws dealing with heating and cooking arrangements in non-domestic buildings. It was evident that the delegates were unanimously of opinion that byelaws should be made and that if experience proved them to be invalid or unworkable, a further effort should be made to amend the law. The passing of the Smoke Abatement Act was welcomed by all who realise the importance of atmospheric cleanliness and it ought not to pass the wit of the officials of the Ministry of Health and of local authorities to frame byelaws which will give effect to the plainly expressed intentions of Parliament both as regards heating and cooking arrangements and injurious smoke of any colour emitted from industrial establishments. Public opinion demands that reasonable steps shall be taken to put a stop to any unreasonable and unnecessary pollution of the atmosphere and it may be hoped that the Resolution of the Conference urging the Ministry of Health to assist in the matter will result in action.

* * * * *

Elsewhere will be found particulars of the extension of the only statutory smoke abatement committee in the country, namely, the one covering the Sheffield and Rotherham area. While the various regional and advisory committees are carrying out some useful work, their powers and possibilities are but small compared with the usefulness of a fully fledged statutory body. The difference lies in the fact that the regional committees can act only in an advisory capacity and as investigating bodies, as far as their limited incomes will permit ; whereas a statutory committee takes over the entire smoke abatement work in the area that it covers, has its own inspectors and other personnel, and derives an adequate income from its constituent authorities. The advantages of such " rationalisation "—if one may use the word here—are many, and must lead to a more efficient and equitable administration of

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the law. Endeavours have been made to set up bodies in other areas, but without success, as sometimes certain authorities (presumably slack ones, who would have to face increased expenditure on smoke abatement administration) have refused to join in. But cannot other areas follow the example of Sheffield and Rotherham, who originated their committee alone, and have now drawn in four other neighbouring authorities? It only needs two or three authorities to constitute a committee, which, when proved successful will soon bring in the adjacent districts. A drafting error in the 1926 Act makes the formation of a committee impossible in London at the moment, but to the West Riding of Yorkshire, Merseyside, Manchester District, Tyneside, Potteries and Midlands, where there should be such bodies, we commend the action of Sheffield, Rotherham and District, who receive our sincere good wishes in the task they are commencing.

* * * * *

It is an encouraging sign to come, with increasing frequency, across paragraphs or articles on smoke abatement topics which begin in some way such as "Now that the question of smoke abatement is so much to the fore......" There does seem to be a gradual but definite awakening of public interest in the problem, which is reflected in articles and paragraphs in the Press, and especially in the correspondence columns of the daily papers. Numerous people take it into their heads to write to the papers about some point—often a heated complaint or a demand for "something to be done." It is good that people should feel the necessity for writing to the papers, and it is good, too, that the papers should publish their letters. Only occasionally is there anything published against the movement, and then it is generally a case of confused thinking of the "where there's muck there's money" type. As an example of this, which arraigns the smoke reformers in a very novel way, we may quote a letter which appeared recently in an evening paper: "In the 'good old days' when plenty of smoke was coming out of all the factory chimneys, etc., our country was in a more prosperous state than it is to-day. If all the factory chimneys are stopped from smoking what will become of the coal trade and colliery workers?" Using similar logic, we can go one better and say: in the still better old days, when Adam delved and Eve span, there was no coal smoke, and never a trace of the unemployment problem!

* * * * *

We recently sent samples of three popular pamphlets which had been used extensively and with success in the Manchester area, to the Medical Officer of Health of all the principal local authorities in the country, intimating that a new edition would shortly be printed, and that copies could be obtained at a cost of less than 10s. per thousand. We anticipated that there would be a fair number of orders, as this seemed to be an inexpensive way of carrying out useful smoke abatement work, and over 150,000 of these same pamphlets had been distributed by the Manchester and District Regional Committee. However, out of the whole country there were only five orders, with the result that we have not been able to print the pamphlets at an economic price. We are sorry that health committees are not yet sufficiently interested in the smoke question to make use of the facilities which the Society is only too eager to offer them. The remedies for such a state of things are two :— to go on hammering at the local authorities and extending our propaganda generally until smoke abatement is taken up as other health reforms have been taken up, and secondly, to increase our funds so that we may offer our services either free or at so low a cost that the gospel of clean air may be carried into even the most parsimonious township in the land.

* * * * *

We thank the many readers who sent us suggestions for the title of this *Journal*. The Committee, after careful consideration, decided to adopt the orthodox method of naming the official organ of an association, by calling it simply, the Journal of the National Smoke Abatement Society. Short descriptive titles have their advantages, but in all that were considered there seemed to be some corresponding disadvantage. It was felt, too, that by adopting the present name, there would be no further danger of inadvertently misappropriating a title already in use. There are two other points on which the suggestions of our readers would be helpful, and we again invite their ideas. It would be very useful to have, especially for imprinting upon our publications and stationery, both a symbol or "device" and an expressive motto. The committee has considered various symbols, but so far without having found a satisfactory one. It is desirous to stress, of course, the positive clean air rather than the negative, smoke; and clean air appears to be difficult to express graphically. Various slogans have, of course, been used frequently, and some posters, at present in the course of preparation, will bear the slogans: "Where there's Smoke there's Waste," "Smokeless Homes are Cleaner Homes," "For Health's Sake, Stop that Smoke," and "For Brighter Days, Try Smokeless Ways." But these

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In your attack on dust and dirt every day your best aid is an Electric Suction Cleaner.

The Electric way of cleaning, collects dirt and allows it to be destroyed without danger to health or scattering the dust everywhere.

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only state separate aspects of the subject. Can anyone put forward a comprehensive, dignified and striking motto, in English or Latin, which will remain fresh and do good work wherever it may go?

* * * * *

The north-bound train had crossed the Yorkshire border and was proceeding through the West Riding. A passenger from Devon was struck by the number of tunnels through which they had passed. The last one, though, seemed extraordinarily long, and at last he turned to a fellow-passenger: "My word, but this is a long tunnel." The other laughed, and replied: Tunnel? This is no tunnel—its Leeds!"

Smoke Abatement in U.S.A.

By H. B. Meller, Head, Air Pollution Investigation and Senior Industrial Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania, U.S.A.; and Chief Bureau of Smoke Regulation, Department of PublicHealth, City of Pittsburgh.

Smoke Abatement has been the subject of talk in this country for a century and a half, and as far back as the latter part of the seventeenth century some efforts were made from time to time, in communities using bituminous coal, to lessen the nuisance due to coal smoke.

It was not, however, until about twenty years ago that the movement gained real force and engaged the serious attention of scientists. A specially appointed committee conducted a survey of conditions in Chicago, and Mellon Institute of Industrial Research made a comprehensive study of smoke and its effects in Pittsburgh. Ordinances were passed here and there and the movement grew rapidly. Recently, H. K. Kugel, Deputy Smoke Commissioner of Cleveland, Ohio, sent inquiries to 245 American cities of 30,000 or more population, 165 replies were received, and 130 of the cities have some form of ordinance designed for the purpose of minimizing smoke.

The Anti-Smoke Ordinance.

While ordinances vary considerably in detail, most of them have certain fundamentals in common, such as the prohibition of more than a specified amount of dense smoke, the determination of density by comparision with a standard chart, the control of installation of new equipment and the repair or replacement of equipment in use, regulation of chimney size, draft, fuel, etc., and a form of penalty for violation.

The following extracts from the Pittsburgh anti-smoke ordinance will serve to illustrate:

Section 2. The production or emission within the City, of smoke, the density or shade of which is equal to, or greater than Number three (3) of the Ringlemann Chart, from any stack, except that of a locomotive or steamboat, for a period, or for periods aggregating two (2) minutes or more in any period of fifteen (15) minutes, and the emission of such smoke, from any locomotive or steamboat for a period or periods aggregating one (1) minute or more in any period of eight (8) minutes, except for a period not to exceed twenty (20) consecutive minutes, not to exceed once a day, while a new fire is being built therein, is hereby prohibited.

Section 4. No person or Corporation shall construct, install, reconstruct, alter or repair any furnace, boiler-furnace, stack or other apparatus connected with stack, unless he or it shall make application in writing to the Bureau of Smoke Regulation on the form furnished by the said bureau, duly sworn to before a notary public, or any person authorised to administer oaths, for a permit for such construction, installation, reconstruction, alteration or repair and in and by such application shall give the plans and specifications, showing the style and dimensions of the furnace, boiler-furnace, stack or other apparatus connected with a stack intended to be used a description of the building or part thereof in which such furnace, boiler-furnace, or other apparatus is located, including the means provided for regulating the temperature of such building or part thereof and ventilating the same, and generally all provisions made for preventing smoke, together with a statement of the kind of fuel proposed to be used and of the operating requirements to be made of the furnace or furnaces referred to therein and unless such application shall be passed upon by the Bureau of Smoke Regulation and approved in writing and a permit issued as hereinafter provided; provided, however, that minor or emergency repairs which do not increase the capacity of such furnace, or which do not involve any substantial alteration in such furnace, boiler-furnace, stack or other apparatus, and which do not involve any alteration in the method or efficiency of smoke prevention, may be made without a permit.

Section 8. If any person or corporation shall violate any one or more of the prohibitions or requirements of this ordinance, he or it, shall upon conviction before any police magistrate or alderman of the City of Pittsburgh, be subject to a fine or penalty not exceeding one hundred ($100.00) dollars for each and every violation thereof,

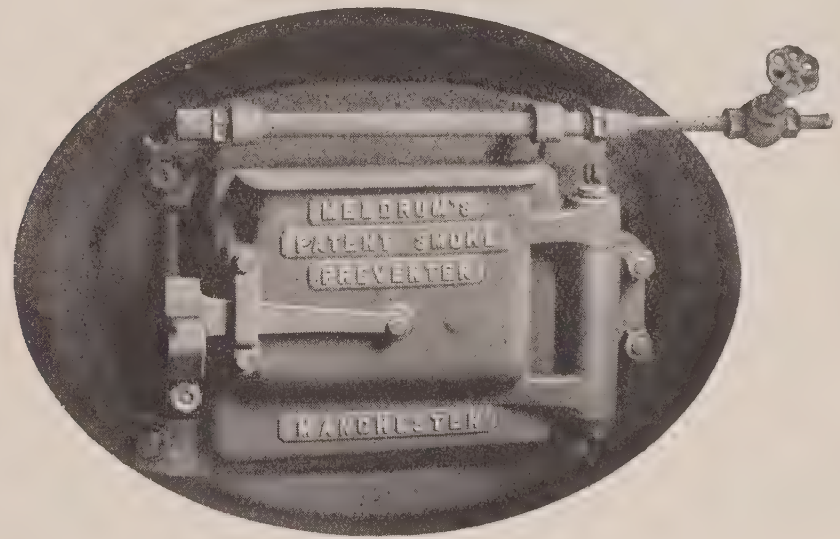
SMOKE-CURE WITH SAVINGS—
THE "MELDRUM" WAY

POSITIVE FEATURES (not found on any other system)

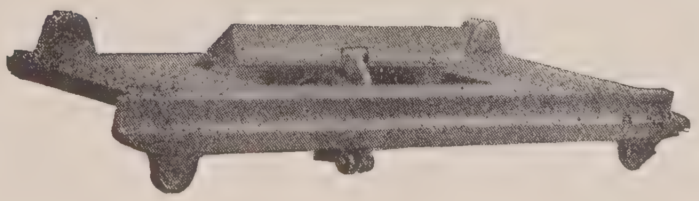
PRODUCE POSITIVE RESULTS.

The " Meldrum " System utilises a closed Ashpit under positive pressure so that the admission of secondary air is not dependent upon Chimney pull but is produced **under the Firebed** and its effect is instantaneous and quite independent of atmospheric conditions. In the case of

THE HANDFIRED FORCED DRAUGHT FURNACE :—

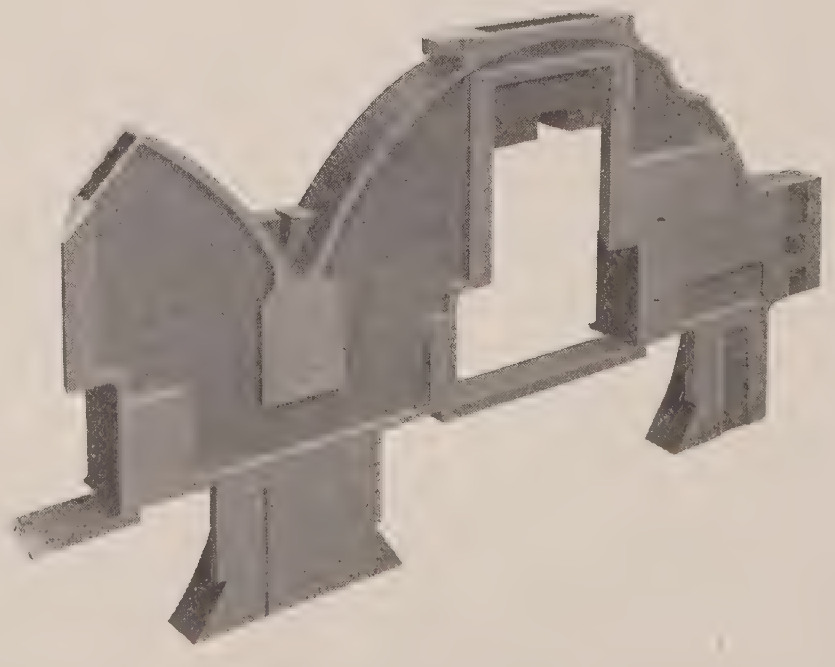


For Vertical Cochran & Loco. Type Boilers—A double or hollow door takes the place of the ordinary firedoor, As will be seen, secondary air is forced down and through this door by steam-jet under control by Wheel Valve.



For Lancs., Cornish, Marine and Yorkshire Type Boilers also Coppers, Kilns & Heating Furnaces :— A Valve in the deadplate (2nd view) opens automatically by the closing of the firedoor. This valve is connected with the closed ashpit under pressure.

Mechanical Stokers :—As bottom view shows a double or hollow Stoker front is used —air is forced down and through this and comes out into the flue—controlled by wheel valves.



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and each day's violation shall constitute a separate offence ; or undergo an imprisonment in the Allegheny County Jail or Workhouse of not more than thirty (30) days or both, at the discretion of the committing magistrate or alderman.

Attempts have been made—notably one by the American Society of Mechanical Engineers—to formulate a type ordinance that could be used as a standard for cities in the United States.

Effects of the Anthracite Strike.

Smoke abatement in some of the eastern states was given an impetus several years ago by the anthracite strike in eastern Pennsylvania. Cities such as Boston, New York and Philadelphia had been large users of this fuel, hence did not need as liberal allowance for dense smoke, nor as rigid regulations regarding boiler and furnace design for smokeless combustion, as did communities whose fuel was bituminous coal. During the strike it became necessary, in this eastern section of the country, to use other coals and oil in equipment designed primarily for anthracite ; but when anthracite mining was resumed, the use of higher volatile fuels was continued and New York and lower New England were faced with an unaccustomed problem, which is being vigorously attacked.

Results of Smoke Abatement.

It may be said that smoke abatement efforts have decreased visible smoke in proportion to the intelligent effort expended. Urban communities have become "smoke conscious," as evidenced by the number of ordinances in effect. Greater discrimination is shown than formerly in the selection and use of equipment and fuels ; plant owners and operators have learned that "smoke means waste" and are willing to co-operate in its abatement. In short, as smoke abatement is very largely a matter of education, consistently better results are being attained year by year. However, there is a wide difference between smoke reduction and smoke elimination.

The Problem of Air Pollution.

It should be noted that laws are made to control visible smoke only, and in most cities private dwellings are exempted. Since air pollution for which the combustion of fuel is responsible consists not only of visible smoke, but of solids that do not appreciably colour the smoke stream, and of noxious and obnoxious gases, it has been clear that smoke abatement as previously understood is inadequate to combat the nuisance. Those interested in air pollution have been preaching this doctrine, until it may be said that practically all communities that have been sufferers are looking for a remedy. Obviously it is a problem for research and has been accepted as such by many American scientists.

The engineer is attempting to improve combustion and at the same time to prevent smoke ; a partial control of solids is affected by means of precipitation ; the sulphur content of coal is being reduced, in some places, by improved methods of washing ; coke and low-volatile (semi-bituminous) coal are being substituted for bituminous coal in many straight-draught boilers ; hand-firing in medium size and larger boilers is giving way to automatic stokers, pulverised coal or oil ; boiler settings are better proportioned, for smokeless combustion, than formerly ; more attention is being paid to proper chimney size ; and in a number of other ways the engineer is making his contribution.

The physicist, the chemist and the physician are much interested in the properties and the constituents of air pollution. Research work has been and is being conducted in various sections of the United States—studies of air-borne solids ; screening of ultraviolet light ; relative amounts of ultraviolet light in the different seasons of the year ; bactericidal effects of ultraviolet light received, and various other phases of the air-pollution problem. Cities in which some of this work has been or is being done are Washington, D.C. ; Baltimore, Md. ; New York, N.Y. ; Boston, Mass. ; Pittsburgh, Pa. ; Chicago, Ill. ; Cleveland, Ohio ; St. Louis, Mo. ; Detroit, Mich. ; and Portland, Ore. Governmental departments such as the U.S. Weather Bureau, the Bureau of Standards, the Bureau of Mines, the Public Health Service ; Health departments of various cities, and educational institutions are interested and at work.

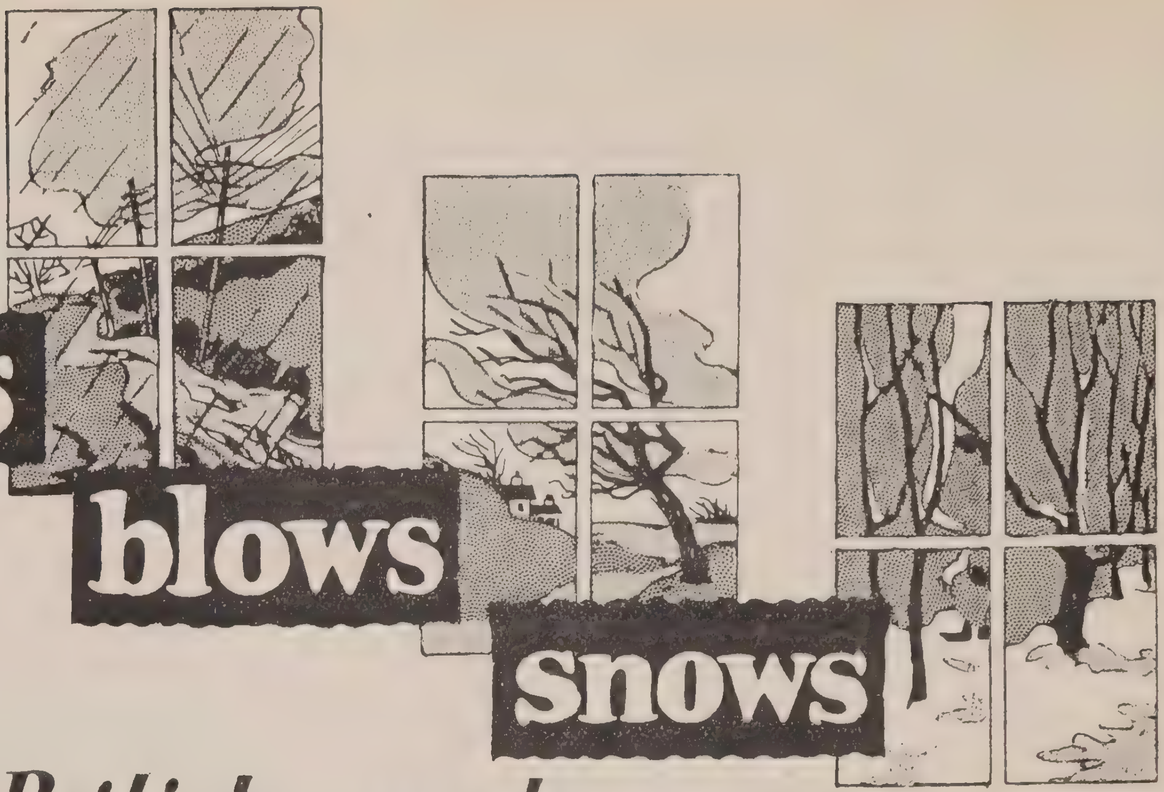
While such research is of interest in itself, one of the most gratifying features is its recognition as a necessary part of smoke abatement. Certainly it is a far cry from the older type of smoke investigation, which aimed at learning only the amount of *soot-fall*. As an instance of the recognition of the various phases of the problem and their relationship to one another, may be mentioned the investigation now being conducted by Mellon Institute of Industrial Research in Pittsburgh. The study includes :

(*a*) Precipitated solids. These are collected daily and monthly from a number of stations. The daily samples are weighed and the weights charted against meteorological data such as temperature, humidity, wind direction and velocity, and rain or snowfall. The monthly samples are analyzed by standard methods.

(*b*) Suspended solids are sampled, counted and sized. These also are chartered against weights of precipitated solids from the same locations and meteorological data.

(*c*) The amount of solar energy is determined by chemical and physical methods. In this connection, a study of the screening effect of atmospheric impurities is being made.

If it rains blows snows



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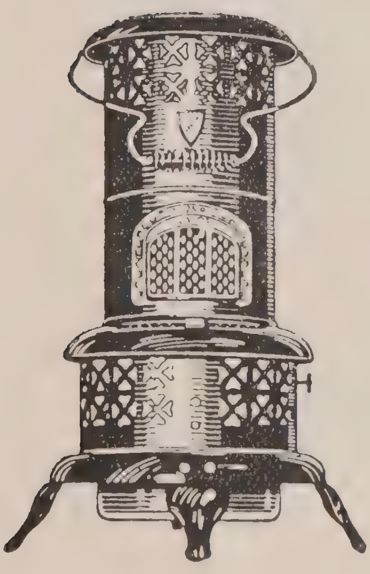

However cold or damp the weather may be, you can have abundant warmth and comfort with the aid of the British-made Valor Oil Heater.

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(*d*) Experimentation with photo-electric cells and their possible uses in an investigation of this character.

(*e*) Corrective measures for further reduction in smoke.

Conclusion.

So that, while the campaign against visible smoke is meeting with measureable success in a number of American cities, and while the people generally are becoming insistent that all reasonable abatement efforts be made, the larger problem of control of all preventable air pollution is engaging the attention of many workers, who have come to a recognition of the fact that what is necessary is not the generally understood "Smoke Abatement," but, finally the cessation of the outpouring of solids and deleterious gases from stacks.

Where Do We Stand?

A Review of the Industrial Aspect of Smoke Abatement.

BY J. B. JONES, A.M.I.Mech.E.

If we consider the amount of energy and enthusiasm shown by those engaged in the Smoke Abatement Movement, we think it will be agreed that the progress made cannot be regarded as satisfactory. For well over two centuries doctors, health authorities, social workers and others have been protesting against the pollution of the atmosphere, which, almost alone amongst the elements that go to make up this world of ours, remains the common property of all.

In the last issue of this journal, extracts were given from what was described as the first Smoke Abatement pamphlet, written about two hundred and seventy years ago, by John Evelyn, who left his readers in no manner of doubt as to his views of the cause of London's smoky and sulphurous atmosphere, and the identity of the culprits. His forcible protest appears to have had little effect, however, as, in Luke Hebert's appendix to Galloway's History of the Steam Engine, published in 1830, we read that "With the laudable object in view of reducing the great and growing evil of dense smoke in populous places, the Society for the Encouragement of Arts, etc., have, for nearly fifty years past, offered a reward for the best method of consuming smoke in steam engines and other furnaces. The constant notification of this reward has probably tended to keep the subject alive in the minds of inventors, but it does not appear to have been productive of many plans being submitted to the Society, that could be deemed of any great practical value. The intrinsic value of the reward was most likely deemed by inventors as a very trifling compensation for a discovery which was calculated to 'make their fortunes,' and induced them to prefer incurring the cost of patents, and thus take a great deal of money out of their pockets, instead of putting a little in; viewing their inventions, of course, as the *ne plus ultra* of perfection, and confidently anticipating golden harvests as their results," and again "The annoyance and pernicious effects experienced by the public from a sooty atmosphere, drew the attention of the legislature to the subject, about twelve years ago; and a select committee of the House of Commons was appointed in 1819, 'to inquire how far it might be practicable to compel persons using steam engines and furnaces in their different works, to erect them in a manner less prejudicial to public health and comfort, and to report their observations thereupon to the House.' ...... "The committee having ascertained and reported to the House that the reduction of smoke from furnaces might be practically accomplished, a bill to embrace that object was brought into the House as passed." The measure, Stat. 1 and 2 Geo. IV. cap 41, was described as "An act for giving greater facility in the prosecution and abatement of nuisances arising from furnaces used in the working of Steam Engines. To commence Sept. 1st, 1821."

It is interesting to note in passing that the first witness examined by the Committee, a Mr. J. Gregson, had already patented a smoke burning furnace, which embodied two effective principles much favoured by inventors of the present day, *i.e.*, the use of preheated secondary air and an incandescent bridge or baffle. Of a truth "there is nothing new under the sun."

More than one hundred and thirty years before this, in 1685, M. Delasme, a French Engineer, had exhibited at the Fair at St. Germain a furnace consuming its own smoke, and this was similar in principle to the one embodied in the patents taken out by James Watt in June, 1785, a century later.

A list of the titles only of Smoke Abatement Patents taken out during the last two hundred and fifty years would fill several pages of this magazine. Each one of these inventions was put forward as a sure and certain cure of the trouble, which, however, is still with us. We have, therefore, during two and a half centuries, had on the one hand a public demand for smoke Abatement, and on the other, the offer of a vast number of so called sure and certain cures. Some of these ideas are quite sound in principle, and, if properly applied and used, would prevent black smoke emission without loss of economy in fuel. Why then do we thus starve in a land of plenty?

FOR CLEAN AIR AND
MAXIMUM SUNLIGHT

USE THE SMOKELESS COAL
NATURE HAS HERSELF PROVIDED

ANTHRACITE

ABSOLUTELY SMOKELESS
HIGHEST IN CARBON, LOWEST IN ASH
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SAFE, CLEAN AND ECONOMICAL IN USE
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For an answer to this question we must closely examine the general attitude of Industry to the subject of Smoke Abatement, and, with this object in view, the writer addressed a questionnaire to the Surveyors of one of the leading Boiler Insurance Companies, covering the whole of the British Isles. The questions were as follows :—

(1) What are your general impressions as to the attitude towards the Smoke Abatement movement of
  (*a*) Power Plant Owners.
  (*b*) Engineers and Boiler Attendants.

(2) Is there any evidence of an increased desire to abolish the nuisance ; and if so is this due to increased regard for the public welfare, or to the fear of being hauled before the Magistrates for black smoke emission ?

(3) Have you noticed any marked improvement in the general knowledge of Engineers and Boiler Attendants regarding the principles of efficient combustion which lie at the root of the matter ?

(4) Do you know of any outstanding cases where improvements have been effected and if so by what means ?

(5) Do you know of any public or privately owned plant in your district in which the products of combustion are washed to eliminate obnoxious chemical fumes ?

(6) What is the practice in your district regarding the use of Soot Blowers, and have you any evidence of ill effects in the immediate neighbourhood of the plants where they are employed ?

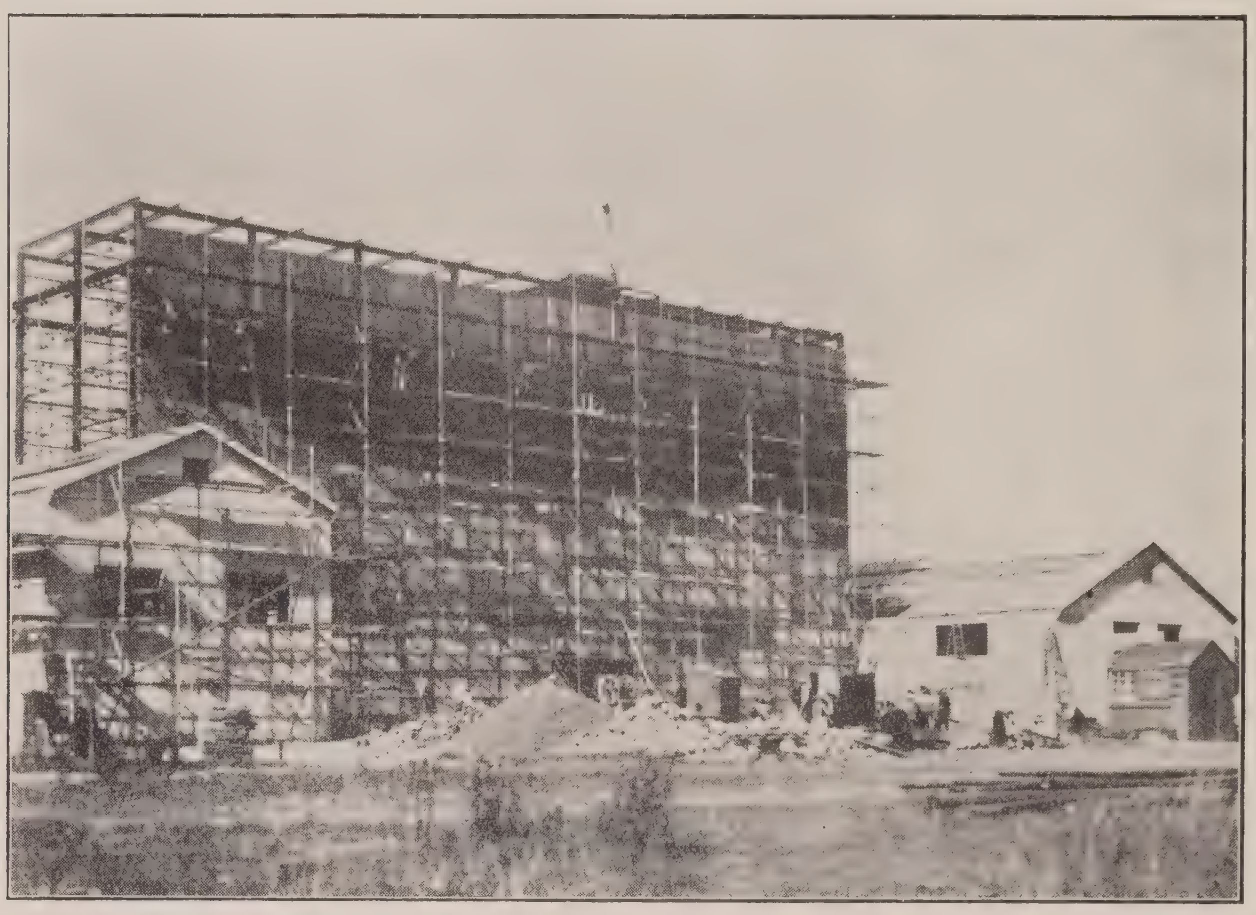
The Replies.

The replies bring little comfort to the enthusiasts who so ardently desire to see the removal of this ugly product of our civilisation. The replies to questions 1 and 2 may be summed up by saying that, execpt in a very few cases, little interest is shown and only the fear of prosecution prompts any really serious attempt to abate the nuisance. There was almost complete unanimity in the replies to question 2, to the effect that, where any attempt has been made, it has been the result of force majeure. The answers to question 3 show that in very few districts is there any evidence of marked improvement in the knowledge of boiler attendants regarding the principles of efficient, and therefore smokless, combustion. In very large plants employing skilled and trained engineers, there is undoubtedly some improvement, but this is due largely to the imperative demand for fuel economy. The replies to question 4 tend to show that improvement has been effected in a number of cases by the use of mechanical stokers, forced draught, increase of boiler power, use of coke or Welsh coal, smoke consuming appliances of various kinds, etc., etc. The vast majority of power plant owners have, however, done little or nothing except blame the fireman, in many cases unjustly, when the authorities have complained or warned them regarding the emission of black smoke from their chimneys.

It must, of course, be remembered that, for the greater portion of the last decade, industry in this country has, for the most part, been passing through a difficult time, corresponding to the seven lean years in biblical history. Even in the fat years, however, some plant owners showed a strange reluctance to equip their Boilers with the simple and comparatively inexpensive instruments such as draught gauges, pyrometers, CO_2; recorders‘ etc., which are indispensible adjuncts to an economical efficient, and therefore almost smokeless steam generating plant. The idea in too many cases is to buy the cheapest coal with which the required steam pressure can by any means be maintained, little attention being paid to the chimney top so long as the smoke Inspector does not give trouble. To attempt, as so many boiler owners do, to burn bituminous or semi-bituminous coal, containing a high percentage of volatile matter, and 15% to 20% of ash, in heavily pressed hand-fired Cornish or Lancashire boilers with fixed grates is, to say the least, foolish. Such coal can only be burned satisfactorily either by pulverising or by chain grate stokers in the large furnaces of water tube boilers.

In the comparatively small number of cases where, as the result of force majeure, attempts have been made to cope with the problem, some owners have resorted to quack remedies to deal with the smoke given off by inefficient furnaces or modes of firing, thus treating the symptons instead of the cause of the trouble. The gullibility of the public and its readiness to swallow patent medicines, and the statements made by those selling them, is one of the most remarkable features of modern life, and it applies almost equally well to the owners of small boiler plants, who, when forced to take some action, will spend often £60 to £80 per boiler in fitting some so called smoke burning gadget instead of tackling the root of the trouble, *i.e.*, incomplete and inefficient combustion. Many of these appliances, e.g. those in which cold or comparatively cold air is admitted through a split bridge, thus diluting the smoke as it leaves the furnace with excess air, will render it less dense at the chimney top, but the economy of the plant suffers and sooner or later the appliance is discarded or allowed to fall out of use. Incandescent baffles beyond the bridges in the flues of hand-fired Cornish and Lancashire boilers are often effective in preventing black smoke, and can be used with advantage in some cases in which the coal used contains an exceptionally high proportion of volatile matter, but such baffles or bridges increase the difficulty and unpleasantness of flue cleaning, and very often they are not repaired or renewed when necessary, with the result that the plant

The Best Way to Reduce Smoke is to Economize Fuel by Insulation



The greater part of this factory will be kept at a temperature of 160° F but the walls and roofs are only 3½″ thick because they are made of THATCHBOARD. It is such an excellent insulator, however, that this factory will require only half the heating plant of one constructed of brick.

THIS MEANS THAT BY THE USE OF THATCHBOARD HALF THE SMOKE HAS BEEN ELIMINATED. If similar construction were extended to all new buildings the smoke problem would be largely Solved.

Ordinary building materials provide very little insulation. For instance 28″ Brickwork in outside walls is only equivalent to 2″ THATCHBOARD.

Therefore, the fuel consumed in heating buildings having brick or masonry walls and tiled or slated roofs is largely wasted in heating the outside air unless insulation is introduced. It has been proved that by using insulation from 30% to 50% of this fuel can be saved.

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falls from grace. If a boiler is not too heavily worked, the steam requirements fairly constant, the coal and the draught good, and the grate area adjusted so as to give a sufficiently high rate of combustion to ensure a high furnace temperature, there is no excuse for black smoke. Even in such cases, however, the fireman is at the mercy of the coal merchant, who, on occasion, will supply coal which is dirty and inferior in quality to that which he has contracted to supply, the public, the boiler owner and the fireman being thus sacrificed on the altar of commercialism.

The Problem of Intermittent Demand.

The problem is more difficult in the case of the boiler plants at collieries and in some of the industries in which a large proportion of the steam generated is used for process work and in which the demand is often irregular and intermittent. When one of the periods of maximum demand suddenly ceases, it is the practice of the fireman to open the furnace doors so as to prevent to some extent the heavy blowing of the safety valves, with the result that the brickwork of the flues is cooled, the fires burn down and get out of condition, and, when a heavy demand for steam is again put upon the boilers, the fires have to be forced to meet it. The result is dense black smoke from the chimney. In the writer's opinion the only satisfactory remedy in such cases is the adoption of some form of thermal or steam storage. There are now several such systems on the market, which, while differing in detail, are similar in principle. Considerable gain in economy is claimed and in many cases such claims will be found to be justified as the principle is essentially sound. This is being recognised and a number of the plants are now in operation in this country. Further developments on these lines will undoubtedly result in some abatement of the smoke nuisance.

The gradual decrease in the number of small boiler plants due to the substitution of electric motors supplied with current from a central power station must, of course, have a beneficial effect on the smoke problem, but there is in this case a fly in the ointment. In the last issue of this journal, a resume was given of a case in which a farmer had taken legal action against the local authority, claiming damages for injury done to his crops by obnoxious fumes from the chimneys of the electric supply station. There is no doubt whatever that the enormous increase in the size of power stations and of the boiler units installed, and also the fact that the furnace draught is obtained by mechanical means, thus allowing the use of much lower chimneys, does result in the atmosphere over a considerable area round such a station being contaminated with chemical fumes, the products of combustion, which are no less injurious to animal and vegetable life than black smoke. The only satisfactory remedy is to purify the gases by washing before they are emitted, and in at least one of the new power stations in London many thousands of pounds are being spent on plant for this purpose.

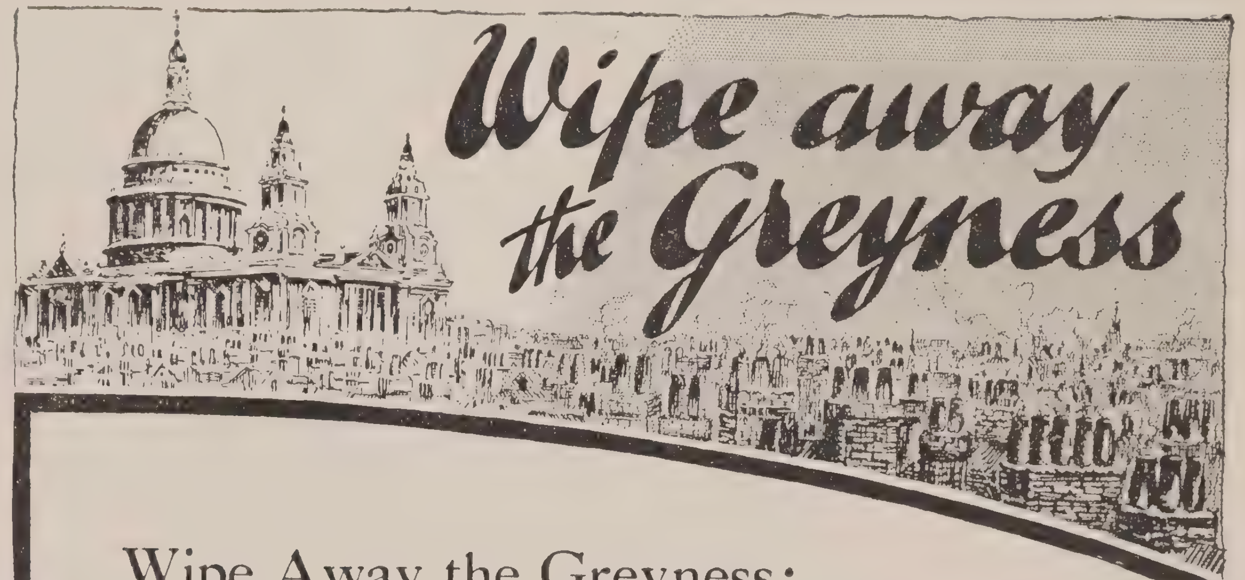
The increased adoption of forced draught for boiler furnaces, while beneficial from the point of view of preventing the emission of black smoke, has resulted in a greater amount of grit and fine particles of ash being deposited over industrial areas. The increased use of "Soot Blowers" has accentuated the trouble. The replies to question 6 of the questionnaire already referred to are illuminating. In one industrial town three soot blowing plants have come under notice. In two cases the chimneys are very high and no ill effects are reported. "The other, owned by the local authority, has resulted in the latter having to clean out, free of charge, the gutters of the surrounding property every six months. Windows and doors of the property on the lee side must be kept shut."

In another district, some firms use soot blowers, "but only at night and when the wind is in a certain direction, otherwise the housewives of the district invoke the majesty of the law."

In many modern power stations the particles of solid matter are trapped or intercepted, in others the gases are de-dusted by washing, but plant of this character is expensive and only the largest and wealthiest firms will consider it unless compelled to do so. The engineers of public supply power stations consider economy first and all the time, and, as the heavy first cost and maintenance of gas washing and purifying plants adds considerably to the overhead charges on their station, they are not enthusiastic, to say the least, with regard to the adoption of such plants.

Prospects of the Future.

What of the future? As we said at the commencement of this article, the present deplorable condition of the atmosphere in almost the whole of the industrial areas of this country, shows that two and a half centuries of effort on the part of those who are by some still regarded as cranks and faddists has had comparatively meagre results, the main stumbling blocks having been commercialism, selfishness and ignorance. We have seen that in the vast majority of cases where improvement has been affected it has been the result of force majeure, and, in the opinion of the writer, it is only by tightening up the law and making the persistent emission of black smoke and poisonous fumes a criminal offence, that rapid progress will be made. Vested interests can exercise a greater influence over local authorities in whose hands the matter now lies, than they can over a central authority, but legislation would be required to bring the matter into line with the Factory Act and within the jurisdiction of the Home Office. Prior to 1902 factory and workshop owners were not required by law to hold certificates of safety for their boilers. There was nothing to prevent them continuing to work defective boilers until the latter exploded and perhaps killed someone. For the purpose of protecting workpeople and others in the vicinity of boilers, the Factory Act



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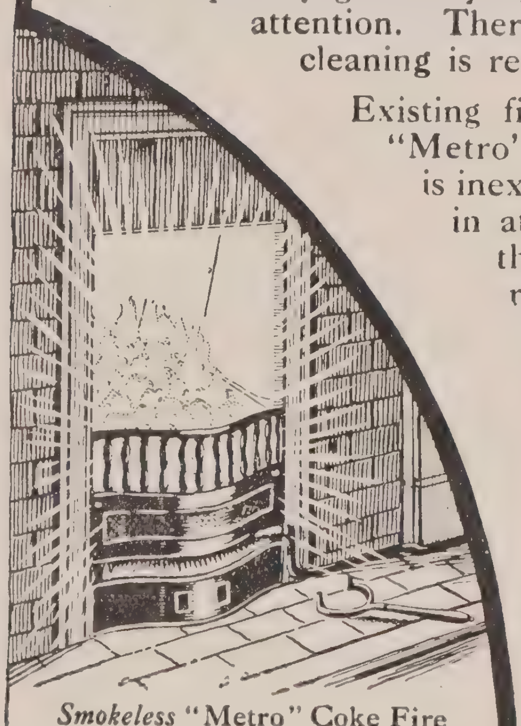

Smokeless "Metro" Coke Fire

was extended in 1902 and every factory and workshop boiler must now be examined at stated intervals by a competent person and must be fitted with certain specified safeguards. No-one will deny that such steps were necessary to protect the public, but the number of lives lost by boiler explosions before the passing of the Act was infinitely small in comparison with the thousands that every year die prematurely owing to lack of sunlight and the inhaling of sulphurous fumes from factory and domestic chimneys, and it is equally necessary that Smoke Abatement legislation should be passed and the laws fearlessly administered. Health Authorities, Smoke Abatement Societies and others have done their best by persuasive means to mend matters, but altruism is almost a negligible factor in industrial life to-day, and it is only by tightening up the law that we shall get marked improvement. The fines that are now imposed in the few cases which are brought before the Police Courts by the Smoke Inspectors are not a sufficient deterrent. If a householder's chimney catches fire either by accident or design, the Police take action, although the injury to the community is negligible compared with that from a Factory chimney emitting black smoke for only a few minutes.

From the foregoing it would appear that, to a very great extent, we hold the boiler owners to blame for the trouble, and it is a fact that they are ultimately responsible, but we are not unmindful of the fact that a careless, lazy or inefficient fireman will bring to nought any commendable attempt of the boiler owners to abate the nuisance. If, however, the law were made more stringent on the lines indicated, these men would not be tolerated.

Improvement as regards industrial smoke would have a very marked effect on the domestic side of the problem and it is not outside the bounds of possibility for a Government by means of a subsidy or otherwise, to enable the public to obtain a reasonably cheap supply of good smokeless fuel for use in domestic grates. Such a step would pay the nation handsomely by way of the improved health and general welfare of the community.

From the Municipalities and Branches

The Greater London Joint Smoke Abatement Committee.

It has been found that it is not possible to set up a statutory committee in London under the 1926 Act, as Clause 6 of that Act is not applicable to London, seeing that the 1875 P.H.A. does not apply to that city. The Joint Committee therefore cannot become, as the law stands at present, anything more than a more or less unofficial organisation. During the last few months the Committee has confined itself to considering what could be done with a view to curtailing the emission of smoke from railway locomotives. In this connection it co-opted to its ranks Sir Henry Fowler (Railway Companies' Association) and Mr. H. C. Charleton, M.P. (National Union of Railwaymen). In the end the Committee came to the conclusion that it would be extremely difficult to fix any standard in this direction, but, with the co-operation of the Railway authorities a simple scheme has been drawn up and circulated to the Railway companies and to local authorities for greater co-operation in the matter.

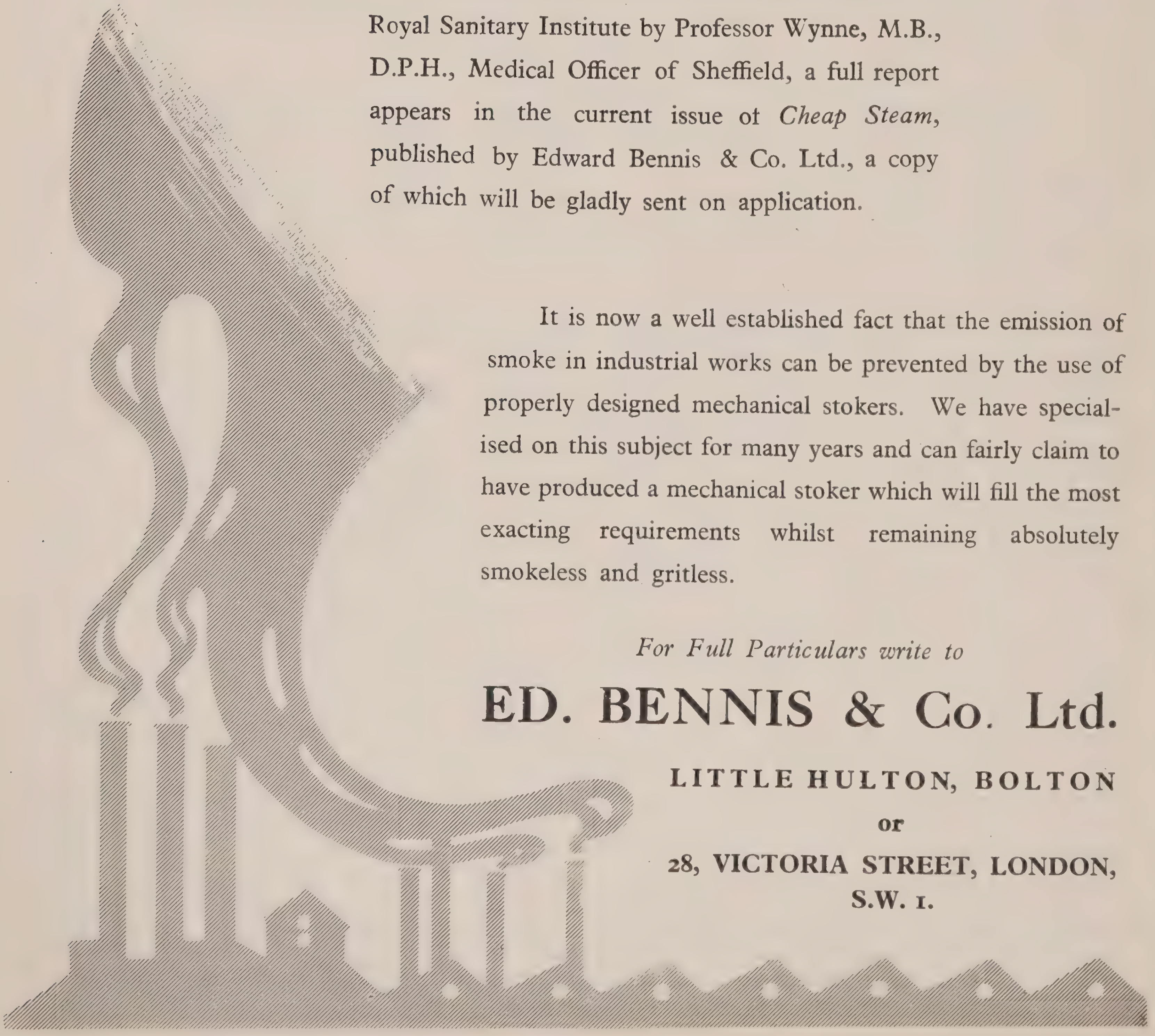
The committee has also had under consideration the question of whether any effective action could be taken with regard to the making of byelaws under section 5 of the 1926 Act. The decision was reached that the powers conferred by this section were too limited in scope, especially with reference to the County of London. Here again the Act is deficient, for under Section 5 the L.C.C. can only proceed under Section 164 of the London Building Act, which eliminates a great number of buildings which are exempt under that Act. This question of byelaws under Section 5 was discussed at the Society's Conference, which is fully described elsewhere.

Sheffield, Rotherham and District Smoke Abatement Committee.

The Sheffield and Rotherham Committee, which is the only statutory committee in the country, has recently extended and is now known as the Sheffield, Rotherham and District Smoke Abatement Committee. The constituent local authorities are Sheffield, the County Borough of Rotherham, the Rotherham Rural District Council, and the Urban Districts of Stocksbridge, Rawmarsh and Greasborough.

The Committee is set up under the provisions of Section 6 of the Public Health (Smoke Abatement) Act 1926, which permits local authorities to carry out their duties under Section 92 of the Public Health Act of 1875, and each of the constituent authorities therefore delegates to the Committee its powers and duties in respect to smoke nuisances.

The Committee consists of eleven members appointed from the six constituent authorities, while the Town Clerk, City Treasurer and Medical Officer of Health for Sheffield act, without remuneration, as Clerk, Accountant and Treasurer, and Medical Adviser, respectively to the Committee. The Town Clerk and the Medical Officer of each of the other authorities may attend meetings in an advisory capacity.



Wipe out that smoke!

" Scientific methods of coal consumption would not only abate the nuisance and promote health and the amenity of life, but would be economical in industry. The emission of black smoke from chimneys serving boilers only is unnecessary and reprehensible."

The above is taken from a paper read before the Royal Sanitary Institute by Professor Wynne, M.B., D.P.H., Medical Officer of Sheffield, a full report appears in the current issue of *Cheap Steam*, published by Edward Bennis & Co. Ltd., a copy of which will be gladly sent on application.

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The expenses of the Committee, including the salaries of smoke inspectors and any other officers and servants who may be appointed are defrayed by the constituent authorities in proportion to their rateable values.

Legal proceedings are instituted by the Committee and are conducted by the Town Clerk, Clerk or Solicitor employed by the authority in which the nuisance arises, and no official in any of the other authorities is permitted to do so. The same applies to the assistance to be given by the Medical Officer.

Manchester and District Regional Smoke Abatement Committee.

The first meeting for the year ending March 31st, 1931, was held in the Lord Mayor's Parlour, Town Hall, Manchester, on May 27th, 1930. Alderman W. T. Jackson was again elected Chairman and Councillor Cunliffe, J.P. (of Farnworth) was re-appointed deputy Chairman. The Executive Committee for the year was also elected. The Hon. Secretary presented reports on the preparation and sale of literature, and lectures given during the winter, and a financial statement from the Hon. Treasurer concluded the business.

The members were then addressed by Mr. W. W. Pettigrew, V.M.H., on "The Effect of Smoke upon City Park Amenities." Comparing the conditions of the parks on the northern side of the city—Heaton Park, Boggart Hole Clough, Philips Park and Clayton Park—with those on the south side, taking Wythenshawe Park as an example, Mr. Pettigrew showed most vividly the appalling effect on vegetation of the polluted air of the northern side of the city. He pointed out that Heaton Park from its natural advantages could be even more beautiful than Wythenshawe, but these advantages were completely neutralised by the smoky atmosphere. Mr. Pettigrew enumerated many trees, shrubs and plants which flourished at Wythenshawe which would not grow in the northern parks. He explained how the beautiful tulip show was made in Philips Park—that each year fresh bulbs from Holland were planted and that they would not be of much use afterwards. He also stated that to keep this park in a presentable condition it required each year 2,500 rhododendrons, the same number of poplars, 1,000 willows, 750 elders, and 300 different kinds of flowering shrubs.

The Scottish Branch.

The Annual Meeting of the Scottish Branch was held at the Town Hall, Coatbridge, on May 5th. Illness unfortunately prevented the Acting-president, Councillor W. Brownhill Smith, from being present. At the business meeting, Provost Irvine, of Coatbridge, was elected President, and Mr. Smith re-elected Acting-president. The Annual Report shows that the Branch has continued its useful activities during the year, the classes for firemen this year having been particularly successful; no less than 110 attending the classes during the session. This is an indication of the wide-spread interest now being taken by manufacturers and public bodies in training their employees in the economical use of fuel. The financial statement of the Hon. Treasurer shows that this side of the Branch is established upon a secure foundation.

The Conference consisted of a number of papers by eminent authorities. Dr. J. R. Currie, Professor of Public Health at Glasgow University spoke on "The Smoke Nuisance and Radiation." A paper on anthracite as a smokeless fuel was given by Professor R. W. Dron, of the Mining Engineering department of Glasgow University, and addresses on electricity and gas were delivered by Mr. D. M. Macleon of the Clyde Valley Electrical Supply Co., and Mr. George Braidwood, manager of the Coatbridge Gas Co. At the close of the Conference the delegates were taken on a tour of inspection of the iron works of Messrs. Wm. Baird & Co., and the Waverley Iron Works.

Dr. Currie, in his address, gave the interesting figures that a five day fog in Glasgow one November, accompanied by frost, raised the death rate from respiratory diseases from 75 to 138 during the week of fog, and to 233 in the following week.

The Manchester, Salford and District Branch.

A Manchester Branch of the Smoke Abatement League of Great Britain was formed some years ago, but was never very active. Those who were interested have, however, got together again and revivified it as the Manchester, Salford and District Branch of the National Smoke Abatement Society. An inaugural meeting was held in February in the Library of the Manchester Cathedral; the outer walls of which provided an object lesson for those who attended. The Dean of Manchester the Very Rev. Hewlett Johnson presided, and the others who spoke were Mrs. L. Stanley Jast and Alderman Melland, Chairman of the National Society. A committee and officers were appointed, the chairman being Mrs. Jast, and the Hon. Secretary, Mr. Charles Gandy (of 3, St. James's Square, Manchester). An excellent list of vice-presidents has been obtained, and the President is the Lord Mayor of Manchester during his term of office. The Branch has since then held its first public meeting, and is taking active steps to secure the necessary co-operation of citizens, as Mr. Gandy has put it, "to meet the co-operation of the chimneys, which is at present too strong for us."

The Nottingham Evening News tries to bring home to the housewife the peril of smoke, by asking a novel question: "Have you ever thought that your Sunday joint may assist in the wearing away of buildings?"

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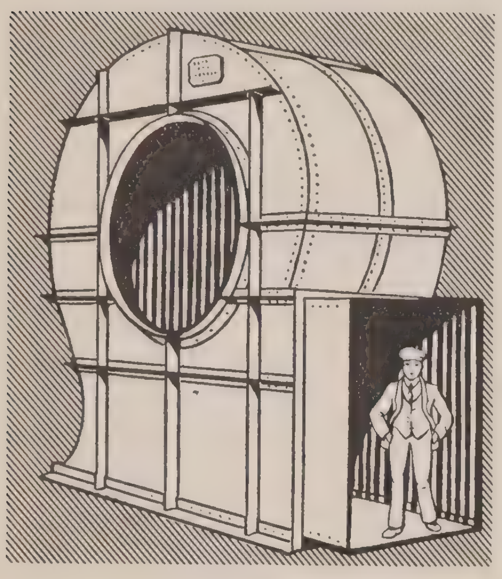

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Current Events

Questions in the House.

In addition to the questions asked by Lieut. Col. Fremantle, M.P., which are given in the report of the London Conference, Dr. Somerville Hastings, M.P., has put the following questions to the Minister of Health :—

March 20th, 1930. *Dr. Hastings* : To ask the Minister of Health, whether he would be prepared to approve byelaws under Section 2, subsections (1) and (2) of the Smoke Abatement Act, 1926, defining noxious smoke as smoke of some specified density as measured by the Ringelmann test, which has been used for many years in the United States of America.

Mr. Greenwood : I am aware that in some places in the United States this test has been used, but no local authority in this country has proposed to embody it in byelaws under the Act of 1926, and, as at present advised, I do not think it is suitable for that purpose.

Dr. Hastings :—to ask the Minister of Health if he will make inquiries whether any convictions have been secured by local authorities since 1926 for the emission of smoke other than black smoke from buildings.

Mr. Greenwood : I have no information of convictions for the emission of other than black smoke, and I do not think that the expense of a general inquiry in order to obtain comprehensive information would be justified. Local authorities generally proceed by representations and usually prosecute only as a last resort.

And at a later date :—

Dr. Hastings :—To ask the Minister of Health if, for the guidance and information of local authorities he will cause to be prepared and issued model byelaws under section 5 of the Smoke Abatement Act, 1926, and if not, will he state what are the technical difficulties involved ?

Miss Lawrence : If a byelaw were confirmed, only the arrangements specified in the byelaw for heating or cooking could be used. Despite the large amount of consideration which has been given to the subject, it has not yet been found practicable to prepare a satisfactory byelaw which would not be open to objection, as restricting heating or cooking to a few specified methods, nor has my Right Hon. Friend received any satisfactory suggestions from any local authority or other body. He will be glad to issue a model byelaw if and when the difficulties can be overcome.

Dr. Hastings : To ask the Minister of Health (1) what are the technical difficulties which prevent him from recommending the use of the Ringelmann smoke chart for the purpose of determining when the smoke emitted from a factory chimney becomes a nuisance ; (2) whether he has taken any steps to ascertain whether in any country, and notably the United States of America, the emission of smoke other than black in colour is an offence ; and if so, whether he will consider the desirability of issuing model byelaws on similar lines ?

Miss Lawrence : The use of the Ringelmann chart has been considered, and while it may be useful as a guide, it has not been considered sufficiently precise under every-day conditions of observation for inclusion in a byelaw. My Right Hon. Friend has reason to think that, in some places in the United States for instance, the emission of smoke other than black may be an offence, as it may be in this country under the Act of 1926. But he has not considered the issue of a model byelaw dealing with other than black smoke advisable until a satisfactory workable means has been devised of observing the quality of such smoke and, unfortunately, though efforts have been made, that has not yet been found practicable.

L.C.C. Byelaw.

The London County Council is applying for a byelaw under the 1926 Act to limit the emission of black smoke from factory chimneys to two minutes in any half hour. Certain sections of industry are opposing this, and an official of the F.B.I. has said that " in London a limit of two minutes in any half-hour is impracticable in present economic conditions. It is to be hoped that some amicable arrangement can be made to extend it to at least three minutes."

Why should it be impracticable to extend to London regulations which have existed in many cities in the country for years ? One hears no complaints from Manchester industrialists, where two minutes has been the limit for a very long period, and it is stated that no difficulties were encountered in enforcing a limit of one-and-a-half minutes in Halifax.

The Gas Grid Scheme.

The Report of the Area Gas Supply Committee is of considerable interest to the smoke abatement movement. It recommends the immediate commencement of a network of gas mains, exceeding 73 miles in length, to take the surplus coke-oven gas produced by the 19 large coke-oven plants in South Yorkshire. There are no technical difficulties in the way. As much as 80 million feet of gas per day may be used through the distributing medium of the gas undertakings, and would be used largely for the service of the steel industry, instead of being wasted, as so much is to-day. The Committee advocate the establishment of a method of charging for gas based on the commodity value of the gas and the service given as well as on the quantity.

They recommend that more favourable terms should be given to large comsumers of gas, provided that adequate safeguards are made to prevent the improper increases in the charges to domestic consumers.

Flue Gases in Modern Power Stations.

Dr. S. L. Pearce has given a valuable paper on the treatment of Flue Gases from modern Power Stations to the World Power Conference at Berlin. As reported in the "Electrical Times" the new Battersea power house will not only make use of the usual grit and dust catchers, but there will be a complete saturating, washing and scrubbing system, which Dr. Pearce expects will result in a practically dust and sulphur free chimney emission. The requirements which he states are essential reveal the complexity of the problem :—low gas velocity, initial humidification by sprays, wetted iron oxide surfaces, a further washing with cold alkaline water, ample contact time, a change in the path of the gases must be made, hot air must be used at the base of the chimney proper to prevent condensation in winter, suitable catalysts, chamber linings, circulation arrangements for wash water, sludge removal, upkeep arrangements for washing materials must be provided.

Educating the Younger Generation in Clean Air.

To write an essay on a subject involves giving some thought to it. We have only to make the public think hard about the condition of the atmosphere in our industrial towns and we shall make further progress with the abatement of coal smoke. To impress the importance of clean air and sunshine on the minds of the younger generation, the British Commercial Gas Association has this year made it the subject of the "Fairy Gas" Competition Essay. Two £50 scholarships and a number of other prizes are offered for the best essays describing the damage done by smoke and the means which can be taken to remedy matters. Parents and children alike should find the competition an interesting one and we hope that school teachers will adopt the Association's suggestion and give a class lesson on the subject and encourage their pupils to enter for the scholarship.

Smoke and Health.

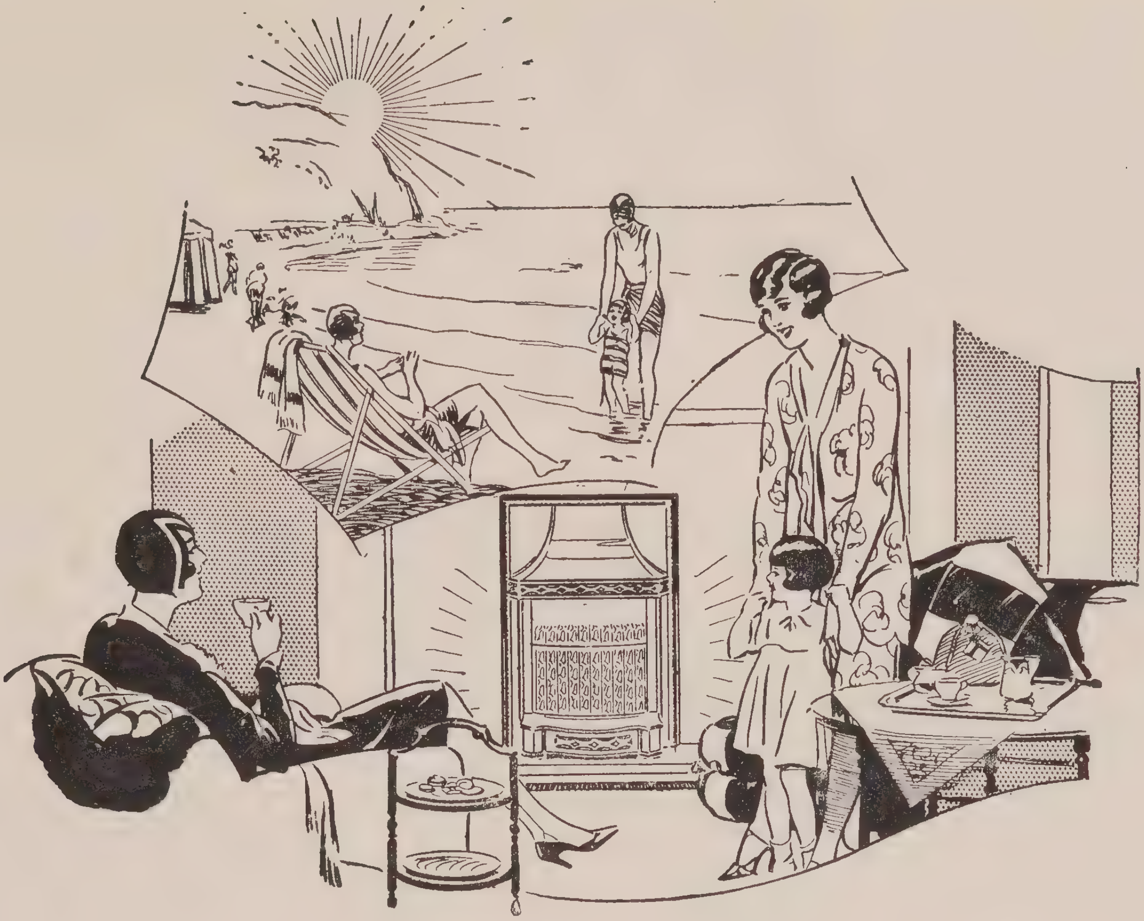
The Joint Committee of the N.S.A.S. and the Manchester and District Regional Committee have published in pamphlet form, the lecture "Smoke and Health," by Dr. J. S. Taylor, Assistant Medical Officer of Health, Manchester. The lecture was one of the course of six which were reported in the last number of the Journal, and in view of its excellence and importance, the Committee decided that it should be published in full. Copies may be obtained from the offices of the Society or from the Manchester Public Health Department, price 2d. each.

The Investigation of Atmospheric Pollution

BY DR. H. A. DES VOEUX.

In the preface to their interesting volume "The Smoke Problem of Great Cities," Sir Napier Shaw and Dr. J. S. Owens give a short account of the developments of the organised collection of records concerning the state of the atmosphere over our large cities. The observations of the state of atmospheric impurity were made by a number of local authorities and others who bore the cost of supplying the necessary apparatus and making the necessary analyses. The work was carried out under the general supervision of a Committee for the Investigation of Atmospheric Pollution "appointed in 1912 to give effect to the wishes of a conference held in London in connexion with a smoke abatement exhibition in that year." Later this Committee became the Advisory Committee on Atmospheric Pollution of the Meteorological Office. In its membership were included a number of representatives of local authorities who were taking observations.

Three years ago, at the request of the Advisory Committee, the Department of Scientific and Industrial Research accepted the responsibility of organising the observations of atmospheric pollution and the conduct of research into its nature and the best method of measuring it. The request of the Committee was accompanied by an offer of subscriptions by a number of local authorities and certain industrial undertakings which were intended to cover at least half the cost of the central services to be carried out by the Department. To assist in the task it had undertaken, the Department appointed a small Advisory Committee of scientific men and secured the services of Dr. Owens as Superintendent of Observations. At the same time the former Advisory Committee became a Standing Conference of Co-operating Bodies, to which all local authorities and industrial undertakings who co-operated in the work, whether by taking observations or as subscribers, are entitled to send representatives. The Conference is an autonomous body, making its own standing orders and appointing its own Chairman. As defined in the standing orders, its objects are "to act as a consultative and advisory body in the investigation and to promote the practical application, in the public interest, of its results."



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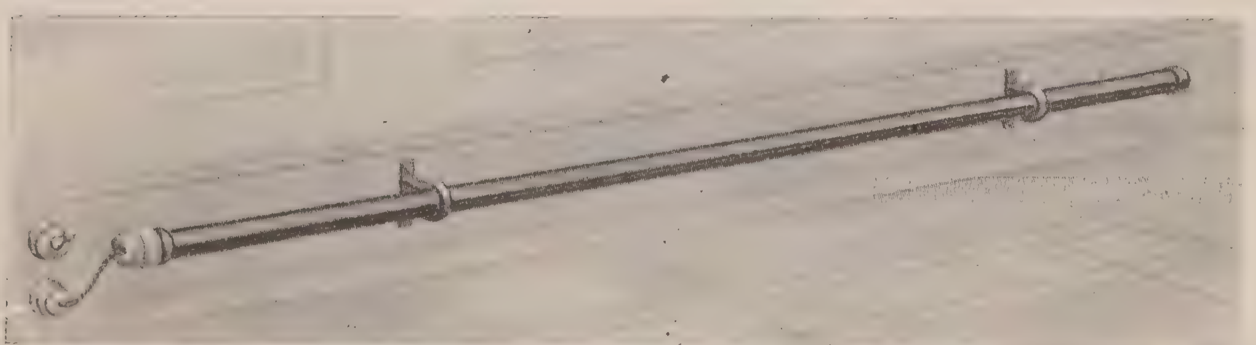

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The object of the co-operative investigation is a scientific one, namely, to obtain practical information as to the nature and amount of atmospheric pollution. It is not concerned with finding remedies for the smoke nuisance, nor is it concerned with what is called propaganda. But it is evident that the Standing Conference of the Co-operating Bodies is already serving a useful and practical function in giving effect to the object described in the extract from its standing orders quoted above. It meets twice a year, and has recently met for the fifth time.

The Conference has sat under the distinguished Chairmanship of Sir Napier Shaw, who recently, at the unanimous wish of the Conference, agreed to serve for a third year. The representative character of the Conference may be gauged from the list of its members which is given in page ix. of the recently published Fourteenth Report on Atmospheric Pollution.*

Any misgivings which those of us who had been associated with the old Advisory Committee may have felt over the experiment of replacing the Committee by the new body have completely disappeared as a result of experience of its working. The attendance at the meetings is very satisfactory, and it is evident that the representatives appreciate the opportunity which the meetings afford of discussing common problems and exchanging views. For those engaged on missionary work there is nothing more encouraging or stimulating than intercourse with others engaged on the same task.

The meeting recently held was very interesting. At a meeting last autumn one of the members had suggested that valuable aid would be given if the steps taken by several authorities to minimise atmospheric pollution became more widely known. It was thought that authorities anxious to take advantage of every practicable means to abate the smoke nuisance would be glad to learn of steps in that direction which had successfully been taken by other authorities. Accordingly, at the request of the Conference, a circular letter was addressed to all Co-operating bodies asking them to communicate information on the subject. The results of these enquiries which were placed in summarised form before the Conference at their recent meeting represent a valuable and interesting compilation of activities all over the country—a compilation which will shortly be circulated for the information of all those taking part in the investigation. Some reference to the nature of the information which has been collected in this way may not be out of place here.

In the first place, emphasis is laid on the value of the example which can be given by local authorities themselves—in the matter, for example, of installing dust collecting devices in local power stations. Exhortations by the Health and Sanitary Authorities on the adoption of smoke abatement measures can hardly be expected to have much effect if the local authority itself, in another capacity, gives cause for serious complaint. Authorities can also encourage attention to the subject by maintaining observations of pollution and sunlight and causing them to be published periodically so as to keep them before the notice of the public.

The smoke problem will remain with us to some extent so long as the domestic open coal fire remains in use. Fortunately, popular habit is changing in the direction of the more extensive use of smokeless solid fuel, gas and electricity. Much may be done by progressive local authorities to foster this development and the opportunities are evidently not lost upon authorities in many instances. For example houses built in connexion with local housing schemes are in many instances, equipped to be heated either wholly or to a large extent by methods other than by burning raw coal. Where the houses are not under the direct control of the local authority, efforts are made by the Health, Gas or Electricity Department to extend the use of smokeless appliances.

Probably, however, the most interesting aspect of activity on the part of local authorities is in the direction of securing the co-operation of local manufacturers. In one case an Advisory Committee has been formed consisting of a representative of the local health committee, and a number of local engineers who are well qualified by experience to advise as to steps which may be taken to minimise smoke emission from factories in particular instances. This Committee has no legal powers, but assists very substantially by considering cases of nuisance and by paying visits to the particular works and making suggestions as to action which might be taken to obviate excessive smoke emission.

Interesting examples were also given in the replies of means which had been adopted to emphasise the importance of classes for firemen in the stoking of furnaces which are held by a number of local authorities. Much information of this nature has been collected which should prove very useful for general reference by Health Departments, etc.

It is evident that the Conference has made a very useful beginning in the collection and dissemination of useful information, and it may confidently be anticipated that its influence as part of the national organisation for cleansing our atmosphere will increase rather than diminish.

In 1912 the total capacity of electric motors in industry was 2,246,000 horse-power. By 1924 this figure had increased to 7,942,000 horse-power. It is stated that this increase has abolished the need for anything from 20,000 to 30,000 factory chimneys.

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* *Report on Observations in the Year ended 31st March.* 1928. *Published by H.M. Stationery Office. Price 3/6 net.*

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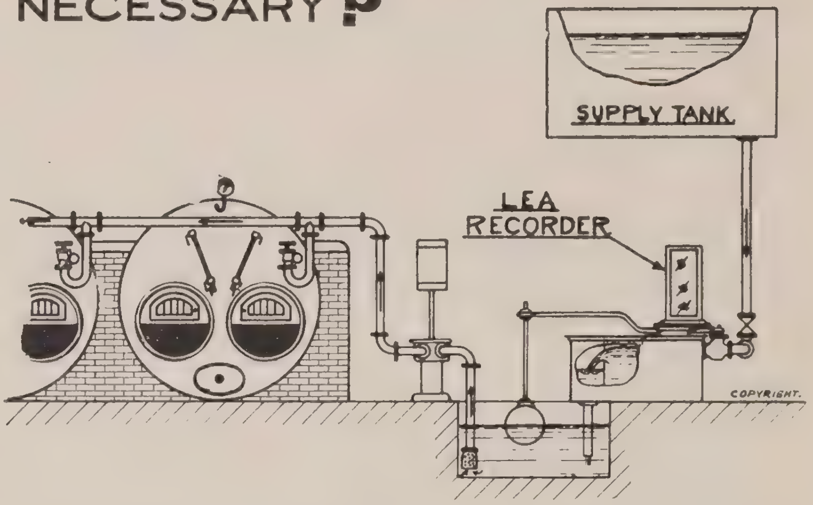

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A Classical Experiment on Atmospheric Pollution

The Society is making rapid progress: we have recieved our first anonymous letter. Because this details a rather extraordinary experiment presumably carried out merely in the interests of Science, we publish it in full :—

SIR,—I am one amongst many who consider that too much noise and fuss is made about the so-called smoke nuisance. To-day there is far less smoke, and far more sickness in the country than ever. I wonder if any member of your Society has ever seen the conditions at the top of a factory chimney? Being interested in this question I ventured not long ago up the laddered chimney of a cotton mill in Lancashire, and during my stay on the platform made a little experiment with a rat enclosed in a cage. Fixing a rod across the mouth of the stack I hung the rat and cage in the centre. Word was conveyed to the firemen to do their worst. Five minutes of dense black smoke followed, everyone present expected the rat to be dead, but when the smoke had subsided a little we found that the rat was alive and no worse for its smoke bath. When the stack was completely clear of smoke the cage with the rat inside was placed in the same position on the rod. Immediately the rat collapsed and was dead in 20 seconds. This happened with a perfectly clear chimney. The writer contends that after such proof as this, there is greater danger from a clear chimney. Obviously, if black smoke does not affect a rat hung over the chimney's mouth I am certain black smoke is harmless to a human being. In conclusion I will say that food adulteration is the sole cause of human ills to-day. Tackle this question and leave smoke alone.

BUNKUM.

So there! But the moral of this tale seems to be that people who live in works chimneys should'nt breathe burnt gases. Apart from such peculiar beings, we still maintain that smoke is injurious to human health, and it is a pity that people who obviously have no knowledge of the principles of combustion should go to so much trouble, and put an end to an innocent rat in doing so. It is probable, and assuming that the story is true, that the black smoke was caused by excessive air, which would cool the gases, and contain a large percentage of oxygen. When the chimney was clear, there would be no oxygen, the air having been completely used for the combustion of the coal, with the consequence that there was none for the rat. The gases would also contain sulphur dioxide, and be at a higher temperature than previously. In the chimney they would, admittedly, be noxious, but once in the atmosphere they would quickly disperse, and their effect would be negligible. The smoke issuing from the chimney would first of all obscure the sunlight, and would then sink to earth in the form of a sticky, acid-laden deposit, with the well-known consequences.

It is a pity that such an experimenter should be content to remain anonymous—the envelope bore the Oldham postmark, and that is all we know—but we can wholeheartedly agree with him in his very ambiguous choice of a nom-de-plume.

Byelaws under Section 5 of the Public Health (Smoke Abatement) Act, 1926

The London Conference

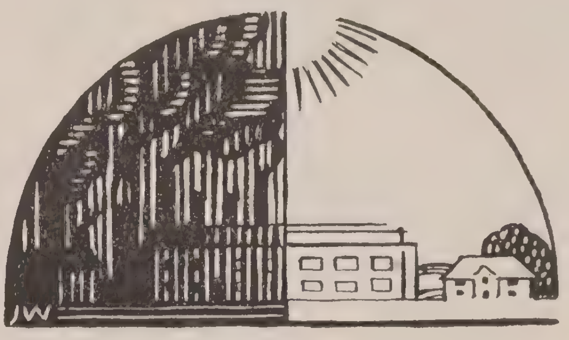
An important Conference of the Society was held at the London Offices, 71, Eccleston Square, on Friday, May 2nd, when Mr. C. J. Allpass, who is Vice-Chairman of the Public Control Committee, L.C.C., and Chairman of the Greater London Regional Smoke Abatement Committee, read a valuable paper on the position with regard to Section 5 of the 1926 Act. The President, Dr. H. A. Des Voeux was in the Chair, and the meeting was attended by many members of the Society and representatives of Local Authorities.

Before Mr. Allpass read his paper Lt. Col. F. E. Fremantle, M.P., who is a member of the Council of the Society, stated that he had asked the Minister of Health a question in the House, as follows :—

"*Lt. Col. Fremantle* asked the Minister of Health how many Local Authorities had made byelaws under Section 5 of the Public Health (Smoke Abatement) Act, 1926; whether model byelaws under this section have been issued from the Ministry of Health for the guidance of Local Authorities; and if not, will he state the reason?

"*Mr. Greenwood*: No Local Authority has made byelaws, or forwarded draft byelaws, under this section. Model byelaws have not yet been issued, by reason of technical difficulties.

"*Lt. Col. Fremantle*: Are the practical difficulties such that in the opinion of the Ministry the Act is practically inoperative?



Smoke and Disease

Smoke is perhaps the gravest danger to our national health.

Statistics show that about fifty per cent. of the time lost in workshops and offices in this country is caused by respiratory diseases due to the pollution of the atmosphere by smoke.

More than half the three-year-olds of this country have rickets, because they are robbed of sunlight by the smoke pall.

The amount of sunlight has been found, by readings taken from various parts of England, to be in inverse proportion to the degree of air pollution.

About seven-eights of the sun's power is shut off by smoke from the centre of London, and eighty tons of poisonous soot are emitted in the capital every hour.

The remedy lies in the burning of the smokeless fuels, gas and gas coke. The atmosphere is not polluted in the slightest degree either during their manufacture or their actual combustion.

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" *Mr. Greenwood* : That may be true. It is clear that the difficulties of framing adequate model byelaws are such that we have not yet been able to overcome them."

Mr. Allpass then read his paper, as follows :—

" There is nothing new under the sun." This is true in some degree of smoke abatement. In comparison with some social problems, however, it is of comparatively recent origin, having existed for no more than 700 years—that is from the time when coal was first used as fuel. Seven hundred years is perhaps but a short space in the history of man. It is nevertheless a sufficient period for the development of reasoned thought as to a possible solution of the smoke problem.

Our legislators in the time of Edward I. and of Queen Elizabeth had a simple, yet effective, method of controlling smoke. They prohibited the burning of coal in London whilst Parliament was sitting. Following the growth of manufacturing industries, however, this salutary method of abatement seems to have fallen into desuetude and it was not until the scathing attack made upon the smoke of London by John Evelyn that what we may call the surgical method of treatment was again proposed, viz., the removal from London of the several trades which were the cause of the smoke nuisance and endangered the health of the King and his people. Since then the smoke problem has grown in magnitude with our prosperity and for a time it seems that the smoky chimney was looked upon as a sign of national well-being.

In consequence the surgical method of treatment gave place to one which may be likened to that of the physician. The user of furnaces was called upon to observe certain elementary rules, and if he failed to do so, small doses of unpalatable medicine—in the way of fines—were sometimes administered. In the course of time health societies or smoke abatement socieites were formed and they did much towards helping the patient to observe the rules and in bringing to the notice of the physician any delinquencies which called for the dosage of medicine referred to above.

The technique of treatment has altered but little in the last fifty years but we have at last secured a provision which apparently enables the *root* of the evil to be dealt with. That is to say, it is at last possible to take special steps to secure that in certain buildings the arrangements for cooking or heating shall be of such pattern or so constructed as to prevent or reduce the emission of smoke.

It is my purpose to-day to submit for your consideration a few observations regarding this provision.

If you will allow me I will firstly make a few remarks of a general nature with regard to the provision and to the Public Health (Smoke Abatement) Act, 1926, by virtue of which such requirements may be made.

The 1926 Act.

This Act is, as we all know, the relic of the various Smoke Abatement Bills which were based upon the recommendations of Lord Newton's Committee and which were considered by Parliament in the years 1922-1924. The Bill of 1924 went a step further than the Act of 1926 in as much as provision was made at the Committee stage to secure that the heating and cooking arrangements in new dwelling houses should also be subject to any constructional byelaw which might be made under the powers proposed in the Bill. Although determined attempts were made to secure such a provision in the present Act, the minister in charge of the Bill felt compelled to reject such an amendment principally on the grounds that it would be unwise, in view of the national shortage of dwellings, to take any step which might tend to hinder their erection or which might make them more costly. Whether or not such a provision would have led to any material curtailment of the activities of builders or of the efforts of local authorities to house their peoples, or whether it would have been too drastic an interference with the liberty of the citizen is a subject upon which there is no doubt a considerable division of opinion.

Be that as it may, it is a matter of considerable satisfaction to those who realise to what a large extent the domestic chimney contributes to the output of smoke, that, in the majority of new dwellings, the old-fashioned type of " Kitchener " has given way to the gas cooker or to a lesser degree to the electric cooker, and that the number of open grates for the combustion of bituminous coal has been enormously reduced. And this has been done with due regard to economy and convenience and by many people it will be considered a fair argument to suggest that what has been done voluntarily by the many who have been engaged in erecting new dwellings should in due course be a matter of compulsion for the remainder, wherever the conditions permit of this being done.

It has been suggested on the one hand that the open grate should be abolished and on the other hand that a tax should be imposed upon the use of raw coal. But it is exceedingly doubtful whether public opinion would support such drastic measures, and it may be stated without hesitation that although the open grate, no matter what the type, is not a thoroughly efficient appliance, in which to burn raw coal, it has certain well-known advantages in the matter of ventilation, and in cheering us up in the dark days of winter. The most practical solution at the present time appears to be the provision of a smokeless solid fuel which can be sold at a reasonably competitive price and which will give the pleasing effects associated with the coal fire. Meanwhile I am confident that if the practice of mixing coke with raw coal were more largely adopted by house-

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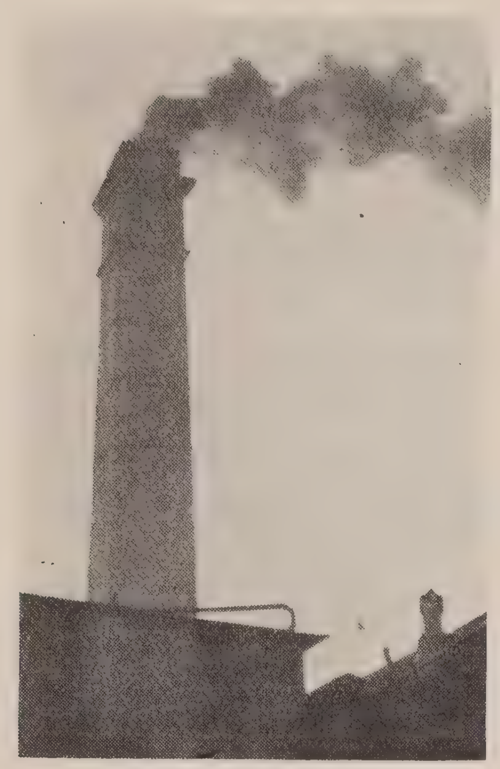

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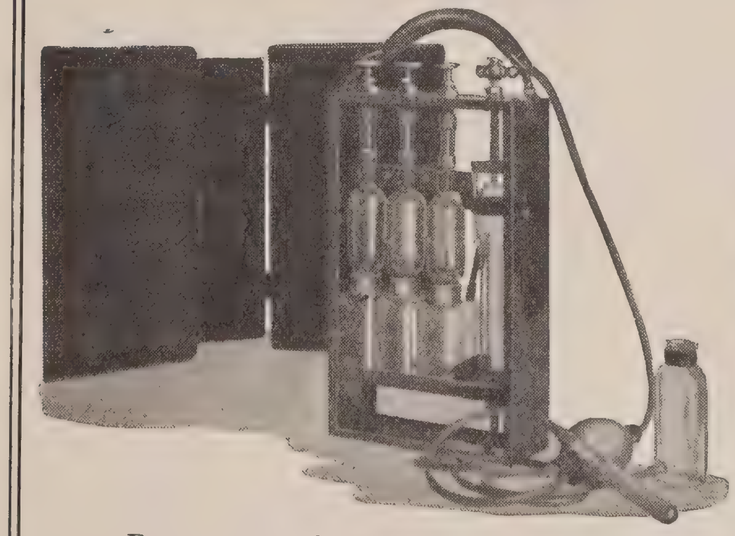

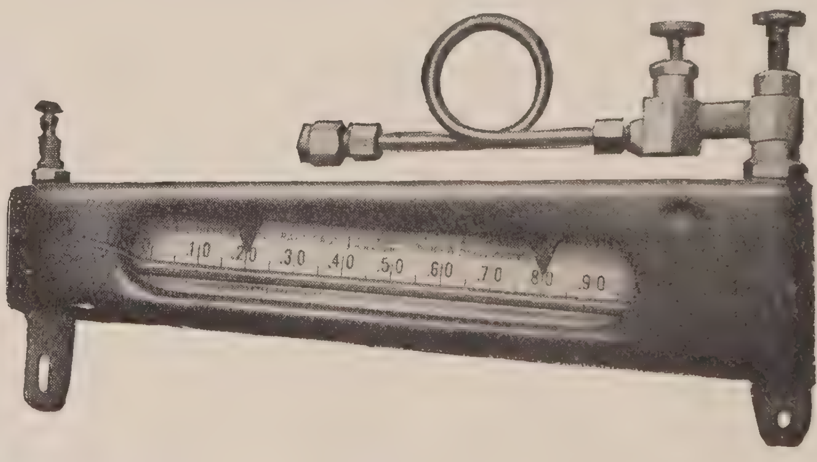

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holders, their open fires would be equally pleasing and no less effective, and the quantity of smoke emitted would be considerably reduced.

But to return to byelaw making powers under the Act. No doubt in 1926 the hearts of smoke abatement protagonists were gladdened by the belief that they would no longer be confronted by that ominous word "black" in its application to smoke; that in fixing smoke standards, the word "black" would be taboo, and that it would not be possible in future to instal in a new building an appliance for cooking or heating which had not satisfied offical requirements as to its efficiency as a non-smoke producer. But are they so happy to-day? They have found that the only byelaw standards in relation to the emission of factory or other smoke that the Ministry of Health will sanction are confined to black smoke and perhaps they now incline to the view that the byelaw making power in sections 2 and 5 is not so effective as it once seemed. It is, however, to section 5 that I specially wish to draw your attention. Let us take the section and examine it.

> "*The powers of an urban authority under section* 157 *of the Public Health Act*, 1875, *and of the London County Council under Section* 164 *of the London Building Act*, 1894, *shall extend to the making of byelaws requiring the provision in new buildings, other than private dwelling houses, of such arrangements for heating and cooking as are calculated to prevent or reduce the emission of smoke.*"

The Meaning of Heating.

It is first of all desirable to pay particular attention to the words "heating" and "cooking" and to arrive at a reasoned conclusion as to their meaning. So far as the word "cooking" is concerned there is no amgibuity but the scope of the expression "heating" is open to argument. An arrangement for heating may mean an appliance for the generation of heat and such heat may be used either for the heating of the air in a building, or in connection with manufacturing processes, that is, the heating of water for the purpose of raising steam or the direct application of heat to a substance. Eminent Counsel has advised that, although the right construction of the expression "heating" can only be determined by a judicial decision, inasmuch as no words of limitation are inserted in the section, byelaws under the section may be made upon the assumption that "heating" is intended to be of general application and to include the heating of furnaces, boilers, etc., as well as the ordinary heating of premises.

Assuming then that this ample power has been conferred on local authorities, we must not forget that the various Public Health Acts relative to smoke are to be construed as one, and the byelaws must, therefore, not override the respective provisions of sections 23 and 24 of the Public Health (London) Act, 1891, or 91 (7) of the Public Health Act, 1875, viz., that where a person is before a Court in respect of a nuisance from a fireplace or furnace which does not consume the smoke, the Court shall hold that no nuisance is created within the meaning of the Act and dismiss the complaint, if satisfied that the fireplace or furnace is constructed so as to consume the smoke *so far as practicable*, (having regard to the mature of the manufacture or trade) and that such fireplace or furnace has been carefully attended to by the person having charge thereof.

But the Minister of Health has taken a different view with regard to the meaning of the word "heating" and has stated that it does not include the generation of heat for manufacturing purposes.

In view of this Departmental expression of opinion it is interesting to recall the words of the Marquess of Salisbury when opposing, on behalf of the Government, Lord Newton's amendment that the byelaws should also relate to private dwelling houses. He said:—

> "I frankly admit that as the Bill was drawn and introduced into Your Lordship's House, the design was not to deal with private houses. The design was to deal with factories and other such quasi-public buildings and to leave domestic buildings alone."

As regards London, we find that a large number of new buildings are exempt from the requirements of the constructional byelaw made under the London Building Act, 1894. Equally so will they be exempt from any byelaws made with regard to heating and cooking arrangements. This fact, when taken in conjunction with the Minister's ruling, leads one to believe that any byelaws which may be made under the section will not, as regards London be of much practical use. Urban authorities, however, do not appear to have the same limitations imposed upon them by the Public Health Act, 1875, inasmuch as the buildings exempted from the Act appear to be only those belonging to a railway company and used for the purposes of such company under any Act of Parliament.

So far as the general scope of the byelaws is concerned, I think it will be of interest to place before you questions under this head which were addressed by the London County Council to the Ministry of Health.

The Minister of Health's Replies.

Briefly, the Minister's conclusions are as follows:—The byelaws must deal with matters of construction; a requirement that the boiler plant provided for heating a building so heated should be adequate for the peak load would be intra vires, though more precise terms would be desirable in order to avoid attack for uncertainty. So again, a byelaw which, for example, merely prohibited the provision of open grates would *not* in the Minister's view satisfy the section; some

¶ There must be thousands of people who are interested in the work of our organisation. Many of them would be interested in this Journal. You would be doing both them and us a favour by handing them a copy.

This Journal is the official publication of the National Smoke Abatement Society.

It chronicles the Society's activities and contains articles by our leading supporters. It's advertisement pages show the appliances and give the names of the firms who make them, which are making possible the fulfilment of our aims.

Order your regular copy at once.

guidance must be given as to what is to be provided as well as what is not. But a byelaw which ran, *e.g.*, "every person who constructs an open grate in a new building, shall, for the purpose of preventing or reducing the emission of smoke, provide the following arrangements"—and then whatever the Council thought necessary would be the kind of byelaw the Council contemplates. A byelaw which required a plan of the "arrangements" to be provided and then left it to the local authority to decide on each submission of a plan whether the arrangements would be accepted or rejected would not be acceptable to the Minister.

Moreover it would not be possible to specify that certain kinds of fuel shall be used in particular cases.

It, therefore, follows that a requirement cannot properly be made that anthracite coal, gas or electricity shall be used for cooking purposes in new hotel buildings, say, or for smokeless fuel to be burned where open grates are used for heating such buildings.

Perhaps a reference to the ordinances of certain of the United States of America may be of interest. It will be seen that there is a somewhat general requirement for plans and complete specification to be submitted to the appropriate authority prior to the erection or construction of furnaces or chimney stacks in buildings used for trade purposes.

Requirements in Germany follow the same general lines.

If byelaws are to be made as to construction this method will seem to a great many people to be the most appropriate and they will urge that such provision may well be extended to all new buildings whatever the use to which they would be put; and that in order to safeguard the rights of the citizen there should be an appeal to a central body—such as the Ministry of Health—against the decision of a local authority.

Arguments which might be used against such wide powers are in particular :—

(1) That furnaces or fireplaces which had satisfied the requirements of a local authority might in use emit smoke; and

(2) That the administration of the powers would entail considerable expenditure.

With regard to (1) there is a general provision in the ordinances previously referred to that the holding of a certificate from the appropriate department shall not exempt the holder from prosecution for violation of the smoke ordinance. Such provision is by no means unfair, for it is well known that much of the smoke emitted to-day is due to carelessness in stoking, to the burning of highly bituminous coal or to the overloading of plant.

As regards (2) it has been estimated that our annual expenditure due to smoke (on a conservative basis) is in excess of £6,000,000. It is probable that in the course of a few years this sum would be considerably reduced by the wise application of the powers foreshadowed above.

But this is a mere suggestion. It must not be forgotten that the Minister has decided that the powers conferred by the section do not permit local authorities to deal with each case on its merits. So far as London is concerned it must be remembered that section 164 of the London Building Act, 1894, provides inter alia that not less than two months before applying to the Ministry of Health for the allowance of a byelaw as to construction the London County Council shall send a copy of the proposed byelaws to the Royal Institute of British Architects, the Surveyors' Institution and the Institute of Builders, etc., etc., and to such other bodies as the Minister may direct.

Under section 184 of the Public Health Act, 1875, a local authority is required (1) to advertise at least one month before the due date of its intention to apply to the Ministry of Health for confirmation of a byelaw; and (2) for a prescribed period to exhibit publicly at its office a copy of the proposed byelaws.

The Minister takes the view that the submission of plans and a decision upon each case as to its suitableness is contrary to the scheme of legislation outlined in section 164 of the London Building Act. It would appear that although the Act of 1875 is less onerous in requirements the principle as to the confirmation of byelaws is the same, and therefore that the Minister's ruling would apply equally to byelaws made under that Act.

I would now call attention for a moment to the following extracts from the report on Smoke Abatement issued by the Royal Institute of British Architects :—

Notes for Architects on Smoke Abatement.

When designing public buildings such as Town Halls, libraries and schools, etc., the local authority should see that suitable provision is made for preventing or reducing to a minimum the emission of smoke.

Where, as will frequently be the case, the whole building is warmed by means of a central heating apparatus, the matter of smoke abatement will be simple; whether the medium adopted be hot water, steam or warm air, the main consideration in reference to smoke abatement will be to use smokeless fuel such as coke or anthracite in the heater or boiler. There may, however, be parts of a building or rooms which, on account of their purpose or the limited occasions of their use cannot conveniently depend upon a central heating apparatus. In such cases some other provision must be made, and the alternatives are (1) the use of gas for heating, (2) the use of electricity, (3) the use of smokeless fuel or (4) the use of apparatus which is adapted to burn coal with the least necessary smoke.

Gas—The chief consideration is to provide proper flues or other suitable outlets for the products of combustion, which though not visible may none the less be dangerous to health if allowed to escape into a room inadequately ventilated.

Coke.—When fixing open grates intended to burn coke, attention to the following points will tend to ensure success :—

> If there is little flame to heat up the air entering the chimney flue, that flue should have a good draught. The distance from the top of the fire to the canopy should be rather less than for coal fires, and the fire should not project too far forward to cause risk of any of the products of combustion escaping into the room. The column of fuel should be deep and be well insulated with firebrick except where exposed to view in front. Grooves on ridges in the firebrick to allow air to pass are useful and means to regulate the draught both below the fire and above it are desirable.

Open grates.—Where, owing to local conditions, the use of raw coal must still be regarded—in spite of the serious objections—as the most suitable or economical fuel to use in open fires or in ranges, something may be effected by selecting grates which at least facilitate the reduction of smoke to a minimum by reasonable stoking, for it is recognised that with open coal fires care in stoking must be by far the largest factor in reducing the production of smoke. Control of air supply to the fire enclosure with firebrick insulation, overhanging back low enough to be generally hot, not too great in extent, and hollowed to concentrate the products to the centre are useful features. Probably a suitable grooving of the firebrick assists the supply of air.

Cooking Ranges.—As regards cooking ranges, the leakage of cold air into the flues should be prevented, and a closed firebrick chamber under the fire through which the regulated air supply can be admitted and where it will be warmed before reaching the coal will be found helpful.

The report also states that the Royal Institute of British Architects might with advantage organise means to inform the public and suggest remedies and support any action which would remedy the evil of the smoke nuisance.

To sum up. The powers conferred upon local authorities by section 5 are too limited in scope, particularly as regards the County of London, to permit of byelaws of real value being made ; and the decision of the Minister as to their purport further restricts their sphere of usefulness.

In these circumstances, I submit for discussion the following suggestions :—

(1) That the attention of the Minister of Health be drawn to the limitations imposed under section 5 of the Act of 1926, and that he be requested to take the necessary steps to secure parliamentary authority for the extension of such powers at the earliest possible date.

(2) That the Ministry of Health should be asked to issue model byelaws under the section for the guidance of those concerned.

(3) That this society should secure the co-operation of the Royal Institute of British Architects and of the Institute of Civil Engineers in the investigation of the best means of securing that in *all* new buildings furnaces and fireplaces are constructed so as to consume the smoke arising from the combustible used therein.

A long discussion took place at the conclusion of the paper, and the following resolutions were finally moved by Sir Lawrence Chubb, seconded by Dr. J. W. Graham :—

1. That the attention of the Minister of Health be drawn to the limitations imposed under Section 5 of the Act of 1926, and that he be requested to take steps to enable Local Authorities to obtain a legal decision upon the scope of Byelaws permissible under the Act, and if necessary that he should secure Parliamentary authority for the extension of such powers at the earliest possible date.
2. That the Ministry of Health should be asked to issue model byelaws under the section for the guidance of those concerned.
3. That this Society urges Local Authorities to formulate and send to the Minister of Health byelaws for his approval.
4. That this Society should secure the co-operation of the Royal Institute of British Architects and the Institution of Civil Engineers in the investigation of the best means of securing that in all new buildings furnaces and fireplaces are constructed so as to prevent the smoke arising from the combustibles used therein.

The resolutions were passed unanimously, and the meeting then terminated.

The intensive smoke abatement work which has been carried on at Salt Lake City has been collected together in the form of a report issued by the U.S. Department of Commerce, Bureau of Mines, under the title of "Nine Years of Smoke Abatement Work at Salt Lake City," by Austin Gudmundsen.

The Smoke Abatement Handbook.

The Society is preparing, and will very shortly publish, a "Smoke Abatement Handbook." This is a venture of an entirely new kind, and is an endeavour to give all the essential information on smoke abatement in a small compass. Concise and yet comprehensive articles will deal with the different aspects of the problem, and will survey the causes and nature of coal smoke; its effects; analyses of the deposit; quantities produced; deposit tables; methods of measurement; smoke abatement legislation; sunlight and U.V.R. measurement; industrial smoke problems; the domestic question; gas and gas coke; electricity; anthracite; oil; low temperature carbonization; and general information of all kinds, including a bibliography; a chronological table of smoke abatement events; a list of associations and organisations, and particulars of the National Society, etc., etc.

It is intended to publish fresh editions from time to time, and it is hoped that the handbook will be of value to all who are in any way working on smoke abatement, or are interested in the subject, especially writers and lecturers. The value will be increased by the inclusion of announcements by the principal manufacturers of smokeless mediums, appliances, fires, stoves, etc. The price will be sixpence, and orders may be given now to the Secretary, at 23, King Street, Manchester.

Mr. W. Nicholson, the Chief Smoke Inspector of the Sheffield Corporation retired at the end of June. Mr. Nicholson is one of the best known of the many smoke inspectors who have done so much for smoke abatement outside their official duties. He has been with the Sheffield Corporation since 1890, except for a brief stay in India as a smoke expert for the Government. Mr. Nicholson has given many important papers and lectures on the subject, and has published no less than three books on it. We hope that his retirement will not mean that his valuable knowledge and experience will be lost to the movement.

Smoke from engines is now eliminated at railway stations in New York. A high-pressure steam line is connected to the boiler and steam and hot water are furnished from a stationary power plant until working pressure is maintained. The locomotive then moves from the engine house under its own pressure, but without any fire, to a specially assigned firing-up track some distance away, where the fire of the engine is lighted.—*Civil Engineering.*

According to the latest report on the Investigation of Atmospheric Pollution, Newcastle-upon-Tyne becomes the city with the greatest soot deposit, while Burnley, the previous leader, drops to second place.

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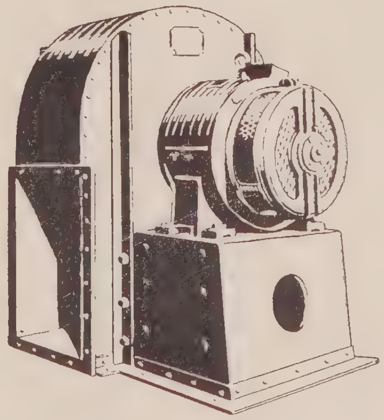

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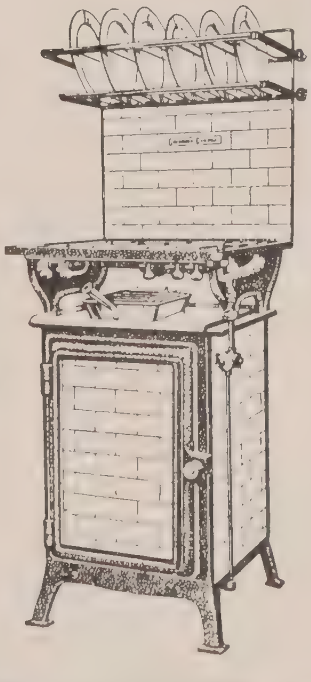

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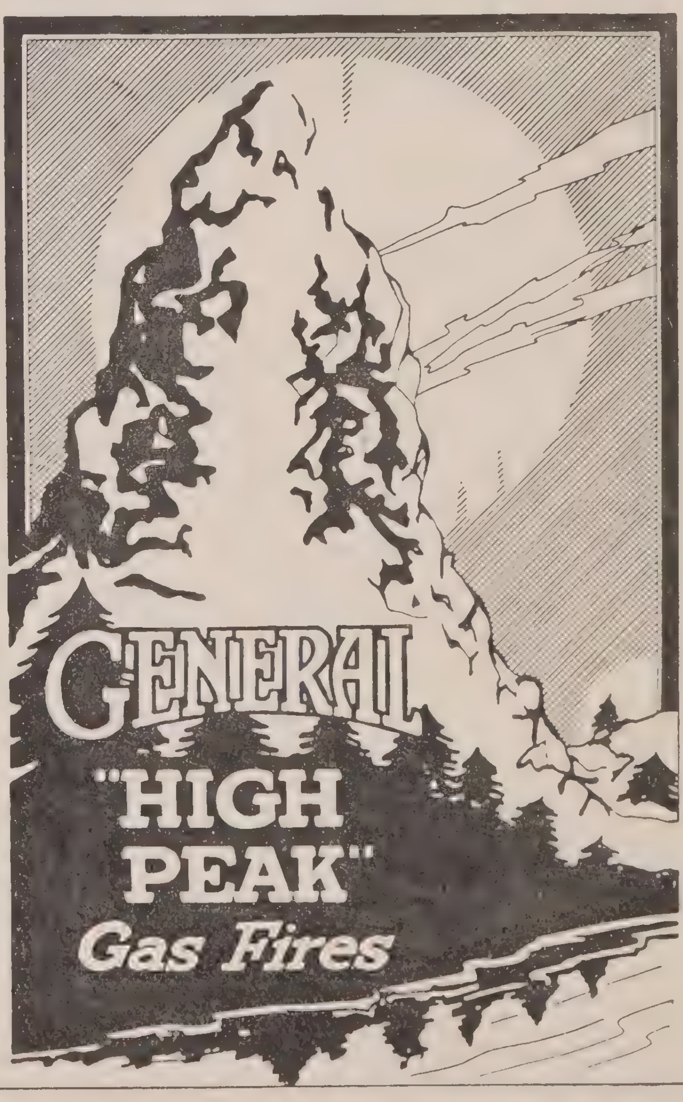

The Journal of the National Smoke Abatement Society

(The Official Quarterly Organ)

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CONTENTS OF AUTUMN ISSUE

	Page
Commentary	107
The Second Annual Conference	111
Insulation and Smoke Prevention Report of Building Research Station	113
Sir Lawrence Chubb on the need for new Bye-laws	117
Correspondence	119
A Synopsis of a Lecture on Smoke and Health ..	119
Atmospheric Pollution as affecting Visibility ..	123
Visibility as affecting Aviation	127
Fuel Research and Smoke Abatement ..	133

COMMENTARY

ELSEWHERE in this issue will be found particulars of the Society's second annual conference, which was held at Leicester on September 26th, 27th and 28th. The Conference was of interest because of two new factors—for the first time the Minister of Health gave his sanction for the expenses of the delegates from local authorities, which is, in effect, a sign of recognition and approval from the Ministry to the Society, and secondly, for the first time also, we had an official invitation from the authority in the town visited. Leicester has set up a precedent, and we sincerely hope that all local authorities who extend invitations to us in the future will do so in the happy and graceful way that Leicester has done. During the week-end we found that this city has many virtues, and her charming hospitality is not among the least of them.

* * * * *

The Conference was marked also by the rare event of having papers on an aspect of the problem that had never been dealt with previously. So much has been said on smoke abatement in the past that it is almost impossible to find entirely new topics for discussion, but the growth of aviation, and the development of municipal aerodromes, with the prospect of regular air services between all the larger towns has made it necessary to consider the serious effect of the smoke pall above the industrial towns and districts. To those who know the facts there is abundant evidence against smoke, but every new indictment is welcomed, especially as we are appealing for a conviction to that most obstinate jury, the British Public, which firmly adheres, in every case, to the principle of belief in innocence until guilt is definitely established.

* * * * *

Our good friends, the British Commercial Gas Association, have kindly sent us copies of the winning essays in their recent competition for school children. The subject this year, as mentioned in our last issue, was smoke abatement, and it is interesting to note the ways in which this is considered by the younger generation. The winner of the £50 scholarship on the boys side was Master Hugh Kerr, of Coatbridge, who takes the figure of the Tree yielding good and evil fruit. The tree of the industrial revolution, he points out, has yielded much good fruit, but also some evil. And smoke is one of the bad fruits, which, unlike some, has not been pruned away, but which remains, as rank as ever. Miss Kathleen Mary Reid, of Heywood, the successful competitor among the girls is not so strikingly

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imaginative, but is emphatic and clear in her condemnation of the evil, and says, in a phrase that would be notable for any adult, that " the gravest charge against any nation is that it does not efficiently safeguard the natural birthright of its children." That charge may, in many ways, be levelled against the present generation, and perhaps the greatest hope for the success of our work is to bring the children themselves to see the evils. The B.C.G.A. deserves our best thanks for having been able to bring smoke abatement before so many of the children of the country. It is a side of our educational work that is engaging the attention of the Society, which hopes to be able to interest the young people in the schools more and more as its activities increase. But this competition, with its 18,000 entries, has done a great deal, and we hope that every child, with the enthusiasm of youth, has already converted its parents.

* * * * *

Members and others will be receiving shortly a letter from the officers of the Society, pointing out how our movement is now in a position to take a big step forward, and asking all to assist us in one way or another, in obtaining the larger income that we require. With the letter will be a summary of the immediate tasks we wish to undertake to increase our influence and strength. This list of methods is not, of course, complete, and we would welcome any suggestions from readers for augmenting it. Knowing full well the fate of many of the appeals which reach all of us, we do ask members not to consign this one to the usual place without having first given it their earnest consideration. We are, without quibbling, frankly asking for more financial support, but even if this is not possible in some cases, there will surely be other ways in which the member can co-operate with us in the advancement of the Society and its ideals. Suggestions are given in the letter, and we commend them to your attention. As it was pointed out at the Annual General Meeting, smoke costs the country £750 every five minutes, while smoke abatement, at present, receives less than that sum every year.

* * * * *

The price list of a coal merchant, which recently came into our hands, finishes up on the following enthusiastic note : " There is nothing like a good coal fire. No heating device is more cheerful, more healthy, more economical. A good coal fire is a typical British institution. It reflects true British comfort and hospitality. It radiates clean, healthy warmth. There is no risk of dangerous fumes. A coal fire is safe, it is hygienic. All good cooks agree that a coal fire provides the best cooking heat. There is no grill like a grill from a coal fire—no baking like coal fire baking. Modern methods of stove heat regulation make a coal fire easily manageable. It is far more economical than any other method of obtaining heat. Buy and burn good coal for the sake of health, cheerfulness and economy." Words almost fail us. No risk of dangerous fumes—close the chimney and watch the result. Hygienic—by disinfecting our lungs with sulphur dioxide, we suppose, and removing any danger of sunstroke in the towns. Economical—yes, except for the 80% heat which is wasted. Radiates a clean healthy warmth—agreed : when it has carbonised itself, so that there is just coke burning, but most certainly not before.

* * * * *

Mr. H. G. Clinch, Chief Inspector, West Ham, was responsible for the following anecdote at the Sanitary Inspector's Association Conference at Ilfracombe. He had been lecturing for an hour or more on how to prevent boiler smoke, to a class consisting largely of firemen. At the end of the lecture was an opportunity for discussion, and one burly veteran rose at the back of the room to deliver his opinion of the problem : Well, sir, say what you will, but coal's nowt but black stuff, and nowt but black stuff can ever come out of it!"

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The Second Annual Conference.

The second annual conference of the Society was held at Leicester on September 26th, 27th and 28th. The conference Headquarters was the Grand Hotel. On the Friday evening a successful public meeting was held in one of the city's public halls, and was opened by an address of welcome to the Society by the Lord Mayor, Councillor C. E. Hincks. The Chair was afterwards taken by the President, Dr. H. A. des Voeux. An address on "Smoke and Health" was given by Dr. R. Veitch Clark, Medical Officer of Health for Manchester. He pointed out that in considering the smoke problem we were considering one of the fundamental causes of ill-health. The problems of water supply, sewage disposal, river pollution, epidemic disease, and housing have all been faced, and though much remains to be done we at least have our feet on the right road. But atmospheric pollution almost alone remains the last of the great problems of health, for a practical solution of which we are still striving. Dr. Clark dealt with the results of the obscuration of sunlight upon the health of the people, and upon the results which occured from the continuous breathing of poisonous and irritant substances in the atmosphere of the towns. Dealing finally with the problem of practical action he pressed very strongly for the institution of statutory regional bodies for smoke control.

The second speaker was Mrs. Millicent Jast, the chairman of the Manchester and District Branch of the Society. She dealt with the problem from the housewife's point of view, declaring that "we are the Protestants of these latter days, standing for our natural endowment of light and pure air as against those who hold with Lancashire that "wheer there's muck there's money." This was a lie. Where there was muck there was poverty —poverty of brains, poverty of spirit, poverty of organisation. There was considerable discussion at the end of the meeting, which closed with a vote of thanks to the Lord Mayor, and the speakers, proposed by Alderman Melland, and seconded by Councillor Keene, a Leicester member of the Executive Committee.

The Annual General Meeting of the Society was held next morning in the Grand Hotel, Dr. des Voeux being in the chair. The annual report and the annual statement of accounts were presented to the meeting, and were both accepted as correct. A resolution was proposed on behalf of the Executive Committee, with regard to a small alteration in the Constitution. After discussion this was agreed to. The business meeting was then adjourned for the first session of the conference proper, which consisted of the papers by Mr. Bennet and Mr. Entwistle, which are given in full in this *Journal*. A rather garbled account of this adjournment was reported in a number of newspapers, which was stated to have taken place owing to the foul atmosphere caused by smoking, and by the presence of two coal fires in the room. The "coal" fires were actually fires burning smokeless fuels for demonstration purposes, and as the day was quite warm enough without them the room did become close, especially as the noise on the main road prevented the windows from being opened when the addresses were being given. The real reason for the adjournment was, however, to permit the erection of a lantern and screen for the use of Messrs. Bennett and Entwistle.

In the afternoon the members and delegates were taken a motor tour by the kind invitation of the Leicester Health Department. Four motor buses, with about eighty members and Leicester friends, set off on what proved to be a most enjoyable and interesting afternoon. The surrounding country was seen at its best, as the day was gloriously sunny and bright. Both the old and the new of Leicester were seen ; the old consisting of the ancient quarter of the town, with its well-preserved council house, where the first Parliament in England was held, and the ruins of a medieval castle at which Lady Jane Grey spent her last night before execution. This was in a magnificent park, recently given to Leicester county and city, in the midst of the Charnwood Forest district. The new was the North Disabled Warriors Homes, an estate of twenty houses for the most disabled men in Leicester, which, delightfully laid out and surrounded by pleasant gardens and lawns, was a tribute to the public spirit of the citizens of Leicester. And then there was the Fire Station. Leicester claims to have one of the best fire stations in the world, and certainly the officials did their best—and successfully—to make the party enjoy its visit. We were entertained to tea in the ballroom above the station, again at the invitation of the hospitable Health Committee, and then the fire brigade gave a most realistic demonstration of turning out and rescuing the unfortunate dummies who dwelt near to the stars in the hose-drying tower.

Even after this the delegates had not finished, for at half-past eight the adjourned annual meeting was continued, and this time successfully concluded. The existing officers and vice-presidents were re-elected, and to the council was added the name of Dr. Margaret Fishenden, who gave a paper on the following day. Dr. J. Johnstone Jervis, who is the leading worker in the active West Riding Regional Committee was elected a Vice-President, as was Councillor Hincks, Lord Mayor of Leicester, and Chairman of the Leicester Health Committee, whose interest in the conference had done so much to render it happy and successful.

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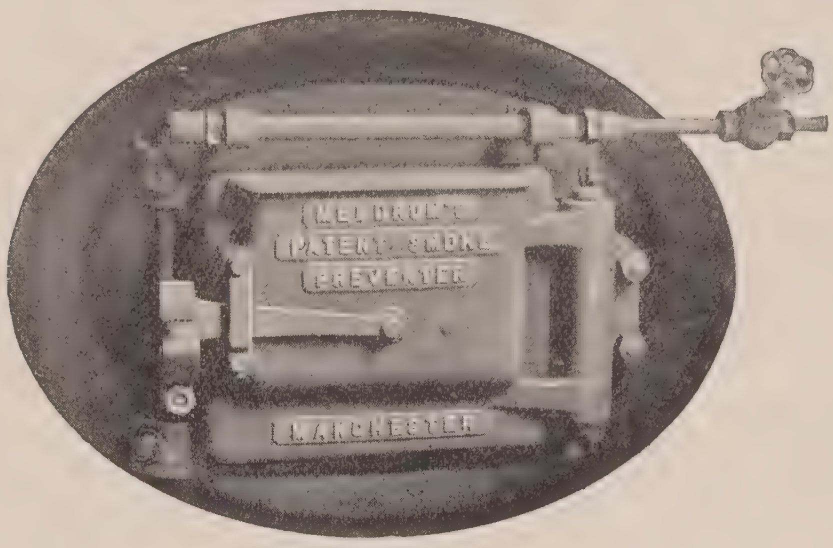

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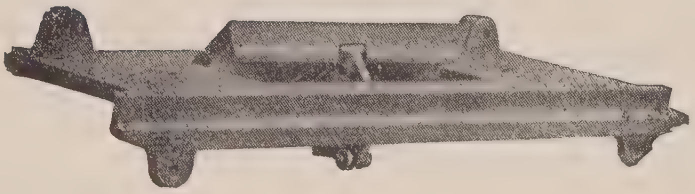

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On the Sunday morning the conference was continued, with Dr. Fishenden's paper on "Fuel Research and Smoke Abatement," after which there was a discussion on the Report to the Sheffield Manufacturers' Smoke Abatement Research Committee. We were fortunate in having at the meeting Mr. E. C. Evans, one of the two authors of this report, and he opened the discussion. Dr. E. W. Smith made also a valuable contribution to the discussion, and many other members joined in, including Councillor W. Asbury, who as Chairman of the Sheffield Health Committee, has a very direct interest in the abatement of smoke in that city.

The last meeting was one of the Council, which took place at three o'clock in the afternoon, after which the conference had officially finished. Delegates from north, east, south and west, could still be seen, however, earnestly discussing problems in the hotel lounge even at eleven p.m., although, of course, by that time they may have departed somewhat from the subject of smoke abatement.

Insulation and Smoke Prevention

It is a very difficult thing to realise a reform by just agreeing that it is desirable. Human nature being what it is we are apt to say—"Let the other fellows get on with it"—and leave it at that. So, in the very big problem of smoke abatement, which requires the co-operation of nearly everybody, we are rather helpless unless we can enlist in our cause some more potent weapons than just a vague sentiment that something ought to be done about it. Luckily, these weapons are all ready to our hand—smokeless fuels, gas, electricity, improved appliances, and last but not least—insulation. What is more, these all go hand in hand. At first sight the connection between insulation and smoke may seem rather remote but this is only because we have got so much accustomed to the existing state of things that we may not have given it much thought. In winter we are in the habit of putting on a thicker overcoat and adding an extra blanket and eiderdown to our bed-clothes, but we have no means of doing the same thing for our houses. Instead we light the fires and turn on the central heating and if we add a little bit more smoke to the general contribution of our fellow townsmen we take it all as part of the normal course of things. Yet that extra blanket for our houses would be effective all the year round. In summer it keeps out heat and makes the room cool, and in winter it does just the opposite and keeps the house warm. It is only a badly insulated building which makes one want to put an overcoat on it in cold weather.

Very probably many house owners have never examined their houses from this point of view. Not one in a million would know how many British Thermal Units were passing through the walls and roof per hour when the temperature is below freezing point. If a heat loss meter could be installed beside the gas meter it might give many people a shock—especially when they realise that they have to put extra shillings into a slot to pay for the heat they are wasting. Heat wasted may or may not mean unnecessary smoke. If the system of heating is the old open coal fire it almost certainly does. But if the heating be by gas or electricity the smoke problem is avoided only at the expense of the householder's purse. It is, therefore, not very difficult to see the part played by insulation in fuel economy and smoke prevention; but there are some very interesting considerations which are not quite so obvious.

First of all, the brickwork or masonry of a wall has to be considered not only as a conductor of heat from inside to outside or vice versa (in inverse proportion to its thickness), but as a storage tank for heat (in direct proportion to its thickness). The effect of this can but be illustrated by taking a concrete example, such as an office. Let us imagine that during a spell of cold weather an office (without insulation) has been left unheated during the week-end. The walls will have cooled down until they are not very far off the tempeture outside. On Monday morning the caretaker lights the fire at 8 a.m. and at 9 a.m. the occupants arrive for their day's work. All the heat radiated by the fire has been used in warming the walls up but owing to their heat storage capacity it will be many hours before they reach a stable temperature. So when the occupants arrive, however near the fire they can get, they cannot get warm. The reason is that their bodies also are giving up heat by radiation to the walls. If these are bare brick or stone the effect will be worst, but the addition of insulation—even only panelling or curtains—will make an enormous improvement. In other words, the presence of an *insulator* prevents the rapid exchange of heat from the fire and all warm bodies in the room to the walls.

This matter of heating up the walls is one thing—the loss of heat through the walls and roof to the outside air is another. But both are equally preventable by insulation and both have a direct bearing on economy of heating and smoke abatement. One of the most convenient, clean and labour saving methods of heating is electricity but compared with other fuels it is apt to be expensive. It would be sheer waste of expensive units to utilize them for heating walls and the air outside, so insulation by preventing this waste is of the

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greatest possible value when electricity is to be the heating medium. In an insulated room, the wall surfaces are warm within a very few minutes of switching on the radiator and very much less heat is required to keep the room warm. All this is a direct inducement to the use of gas and electricity, which can be turned on or off when and as they are needed and regulated to give just the correct amount of heat to suit the conditions. So by insulation not only is less fuel used but the use of those fuels and methods of heating, which are the cleanest and least smoke producing, is encouraged.

In America where extremes of heat and cold are much greater than in this country, the use of an insulating medium in buildings has become common practice. A great deal of scientific research has been carried out in both U.S.A. and Canada but it may not be so well known that our own Department of Scientific and Industrial Research has been investigating this matter at the Building Research Station at Garston.

Appended to this article is a report by the Building Research Station on two identical houses—one of uninsulated brick construction—and one built with a compressed straw insulating material, known as Thatchboard. These two houses were built by a private company, which is making a speciality of insulating materials for building, with the object of showing by an official test that a very great saving in fuel can be obtained by using insulating walls and roofs. The result shows that an uninsulated house requires about 50% more fuel to keep it at the same temperature as an insulated house. This economy of fuel has a direct bearing on smoke prevention. If coal be the fuel, less coal will be burnt. But an even more promising factor lies in the increased possibility of using the cleaner methods of heating, such as electricity, gas, or fuel oil. With the saving which is now shown to be possible, the greater expense of these heating methods is no longer serious. The waste of heat which was regarded with complacency in earlier days when coal was cheap and no one minded smoke can no longer be tolerated. From every point of view—cleanliness—labour saving—economy—smoke prevention—convenience and hygiene, insulation and modern methods of heating go hand in hand.

The day will soon come when we shall merely have to press a button or turn a tap in order to heat our buildings and we shall have forgotten that there ever were such things as smoke, soot, dust and ashes.

Copy of the official report by the Building Research Station of the Department of Scientific and Industrial Research. (Slightly Abridged)

The object of the investigation was the comparison under varying weather conditions, of the heat requirements of a house incorporating "Thatchboard" with those of a similar house of standard brick construction.

The test was carried out on two houses erected at Garston, Watford, near the Building Research Station. The houses were heated electrically, keeping the temperature of corresponding rooms equal by thermostatic control. The heat requirement of each house was then given by the consumption of electric energy in that house.

The houses are small flat roofed six-roomed cottages of a cubical shape identical in size and plan but differing in constructional details. The standard house is of normal construction with 9 in. external brick walls rough-cast on the outside and plastered on the inside. The north wall of the Thatchboard house is of 4½ ins. brick-lined with two inches of Thatchboard; the south wall consists of 4 in. of concrete lined with two inches of Thatchboard. The east and west walls are of 2 in. Thatchboard, the east wall being divided into two by the brick chimney stack serving the living room, parlour and two of the bedrooms. All outside walls are roughcast without and plastered within. The internal partition walls are of single layer Thatchboard plastered. A single layer of Thatchboard is laid below the flooring boards and another above the ceilings of the ground floor rooms. A double layer, separated by an airspace, covers the whole of the roof.

Since the Thatchboard house was screened from wnd sun and rain by the standard house on the west side and by another cottage on the east side, a screen was erected on the west side of the standard house to attempt to equalise weather conditions over the two houses.

Heating was by thirty Tubular Electric Heaters and each room (including the halls) was controlled by a Unity Thermostat. The thermostats were previously calibrated at the Building Research Station by a laboratory experiment. They were paired as to characteristics and installed so that one of a pair was in the standard house whilst its companion controlled the corresponding room of the Thatchboard house. Two motors were installed in each house a main meter recording the total consumption and an auxiliary meter giving the consumption of the living room alone.

During the test period the hall, kitchen and bedrooms of each house were kept at 55°F. and the living room and parlour at 60°F.

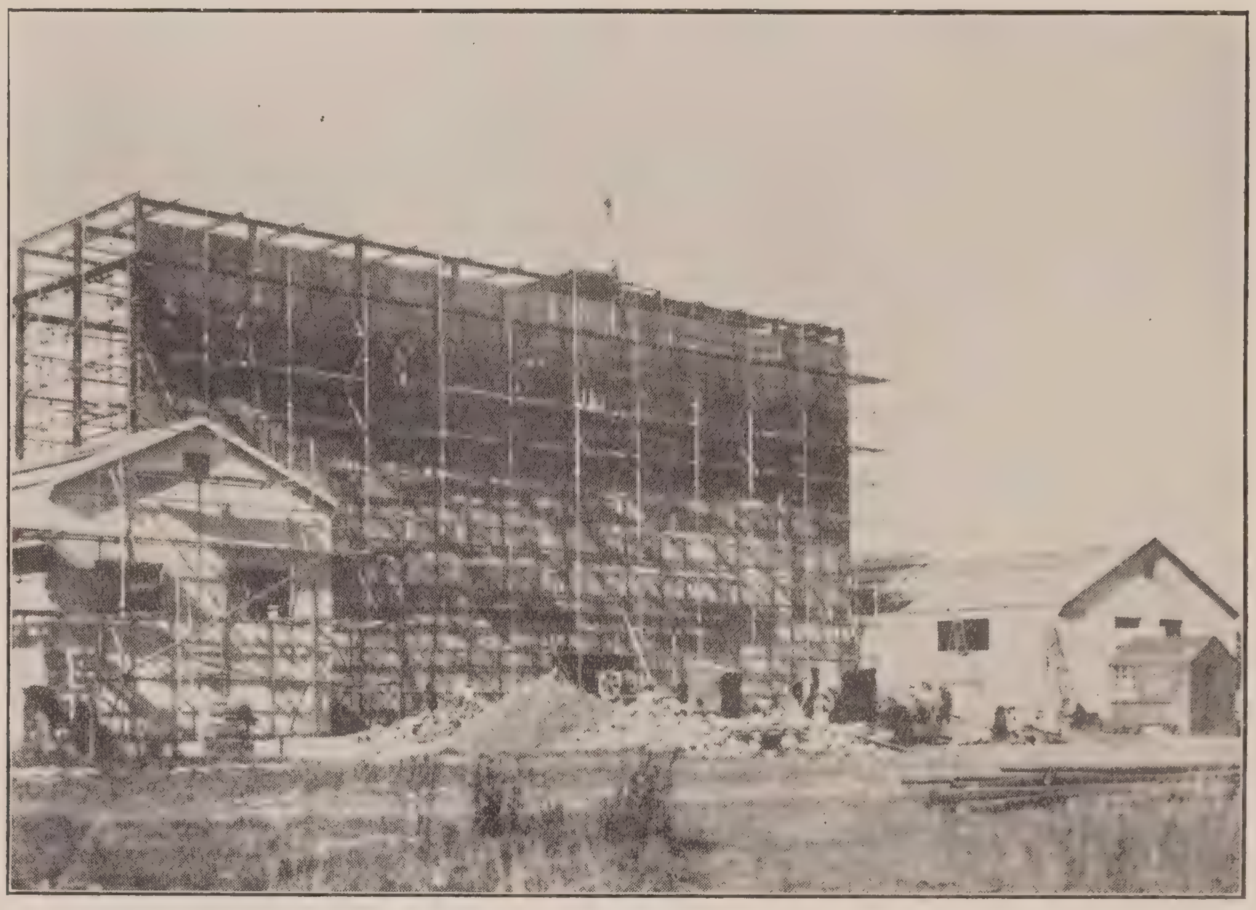
Meter readings were taken at 9-30 a.m. each day.

Heating was commenced on February 8th and continued to April 30th, 1930. During the period February 8th to 20th the windows were kept open so that the buildings might dry out. After the 20th they were closed and except for one or two days on which alterations were being carried out the readings may be taken to be reliable.

The energy taken by the Thatchboard house was throughout the test consistently less than that taken by the standard brick house. The total consumption of the two houses over the period February 20th to April 30th (excluding ten days when alterations were being carried out) were 3342.8 kilowatt-hours for the board and 5397.9 K.W.H. for the brick house. This means that to keep the Thatchboard house at the specified temperature of 60°F. and 55°F. took 62 per cent. or approximately two-thirds of the heat required to maintain those temperatures in the standard brick house.

For temperatures at which the whole house was being heated the Thatchboard house consumption varied from 52.5 per cent. of that of the brick house at 51°F. to 61.3 per cent at 34°F. external temperature. At higher temperatures when the living rooms only were

The Best Way to Reduce Smoke is to Economize Fuel by Insulation



The greater part of this factory will be kept at a temperature of 160° F but the walls and roofs are only $3\frac{1}{2}''$ thick because they are made of THATCHBOARD. It is such an excellent insulator, however, that this factory will require only half the heating plant of one constructed of brick.

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being heated the percentage wasless.

The living rooms showed a similar ratio. The total consumption of the two rooms for the test period (excluding ten days) were 694.6 and 1152.2 kilowatt-hours for Thatchboard and brick house respectively, that is, the living room in the test house took 60.3 per cent. of the heat required by the living room of the brick house.

The results of this test prove that a definite economy in fuel consumption results from the employment of Thatchboard as a walling material, and that this economy may be expected to amount to 35 to 40 per cent. of the heat requirements of a similar brick house.

Sir Lawrence Chubb on the need for New Bye-Laws

Sir Lawrence Chubb, Honorary Advisory Secretary to the Society gave the opening lecture of a series on Smoke Abatement arranged by the Royal Sanitary Institute. He dealt mainly with the legislative side of the subject. As reported in the "Times" of October 7th, Sir Lawrence said that it was a matter of regret that up to the present so little advantage had been taken of the powers available to local authorities. That was not altogether the fault of the Councils. The Act purported to enable byelaws to be made regulating the emission of smoke of any colour, density or content, but up to the present the Ministry of Health had not been disposed to consider the control of any smoke that was not actually black. Although it was no doubt desirable to standardise practice throughout the country, it had to be remembered that the emission of quantities of black smoke had been illegal ever since the Public Health Act of 1875 passed into law. Byelaws dealing with such smoke were, therefore, of secondary importance.

What was urgently needed was a byelaw allowing councils to prevent the emission of dense volumes of opaque smoke, which often did far more harm to health and property than occasional outbursts of really black smoke. The Smoke Abatement Act purported to bring under control noxious smoke regardless of colour, but such smoke could not be effectively dealt with until the byelaws which the Act authorised had, in fact, been formulated by the councils and approved by the Ministry of Health. No real progress in the prevention of atmospheric pollution was likely until such byelaws were available.

Section 5 of the Act authorised the making of byelaws requiring the provision in new buildings other than private dwelling houses of such arrangements for heating or cooking as are calculated to prevent or reduce the emission of smoke. Up to now, that section had been a dead letter, but it was understood that the London County Council and other authorities were considering the desirability of framing byelaws for submission to the Ministry of Health. It was a disappointment to the advocates of the smoke abatement movement that hitherto full use had not been made of the Act.

Examinations for Stokers

The West Riding Committee's Scheme.

The West Riding of Yorkshire Regional Smoke Abatement Committee has drawn up, in conjunction with the various courses of instruction for stokers and firemen in the area, a scheme for examinations, with the granting of certificates for successful candidates.

An examination Board has been set up, and this will determine the places where examinations shall be held, and the nature of the tests. The examination will consist of three parts, as follows :—

(*a*) *Written.* To consist of a paper of eight questions of which six must be answered. Time allowed—two hours.

(*b*) *Oral.* To take place in conjunction with the practical examination, and to deal more particularly with the practical details of boiler-house routine and smoke abatement.

(*c*) *Practical.* To be held at the boiler front, where the candidate shall be required to display his knowledge of the general structure of the boiler and its fittings, its firing, regulation of air, etc.

Candidates must have attended one of the schools in the area at which courses are given, must give evidence of good conduct and industry from their employer, and must have had practical experience in boiler firing or management. The syllabus which the examination will cover, consists of the following subjects: Part 1. Smoke fuel, combustion, heat transmission, boilers, firegrates and bridges, firing methods, draught, feed water, and general survey of effective methods of working efficiently without smoke.

Part 2. will deal with these points to a more advanced degree, and will also consider boiler house instruments and auxiliaries, such as economisers and steam accumulators, and the keeping of records.

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Correspondence

To the Editor.

DEAR SIR,

I was surprised that in her paper to the Annual Conference at Leicester Dr. Margaret Fishenden had so little information to impart on Fuel Research and so much praise to bestow on gas coke and low temperature carbonisation products, without even so much as mentioning nature's smokeless coal—Anthracite.

While agreeing in full measure with the President that a conference is no place in which to advertise that particular smokeless fuel in which one is commercially interested, I make no apology, in view of the prominence which the lecturer gave to high and low temperature cokes, in directing the attention of the readers of the Society's *Journal* to some of the advantages of anthracite. Moreover, the anthracite industry of this country is not confined to one particular company or firm but it is an old established section of the coal industry employing upwards of 20,000 miners in South Wales alone. The anthracite industry of the world is by no means so small or unimportant as to warrant entire neglect when smoke abatement is under consideration, for in U.S.A. more than 60 million tons are consumed annually, and it should be borne in mind that anthracite coal is the fuel most extensively used for domestic purposes in the principal cities of U.S.A. and Canada as well as in France, Italy, Holland, and other European Countries where an economical, clean, continuous burning, low ash, and smokeless fuel of high heating value is deemed to be essential—and surely this should be sufficient reason for giving this coal some place in the discourses of all lecturers on smokeless fuels.

The bulk weight of coke is out of all proportion to its heating value. Whereas a ton of coke occupies 80 cubic feet, a ton of anthracite occupies approximately half that volume. It follows therefore that in a given space three times the quantity of heat can be stored when it is filled with anthracite instead of coke—a most important consideration in houses and flats where the coal storage accommodation, as is so frequently found, is limited.

It is erroneous to imagine that anthracite is an expensive fuel, It should be clearly understood that the price per ton of any fuel is no criterion of its value. The comparative heating values of anthracite and coke are about 3 : 2. That is to say, anthracite at 60/- per ton is no more expensive than coke at 40/- per ton.

I venture to suggest to the Doctor from Birmingham that if he were to try anthracite boiler nuts in his domestic "coke" boiler, he would have no difficulty in keeping it alight throughout the night.

The company with which I am associated is always willing to give users and prospective users of anthracite the benefit of its experience in the application of anthracite for both domestic and industrial purposes and we cordially invite enquiries to write to us for information and advice.

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A Synopsis of a Lecture on "Smoke and Health"

The following is the synopsis of a popular lecture on "Smoke and Health," actually given by Mr. R. Morton Rowe, of Manchester. It is published as a guide to others who may have the opportunity of lecturing. The references to Manchester should be replaced where necessary by figures dealing with the locality in which the lecture is being given.

The chief amount of atmospheric impurity is due to the imperfect combustion of raw bituminous coal. Coal varies very much in its composition but an average good coal will be made up of about

Fixed Carbon	68%
Volatile Matter	25%
Sulphur	1%
Ash	6%

When this is burnt completely the ash is left behind in the grate, and 3 colourless gases pass off into the atmosphere and are rapidly dissipated or diffused in the vast ocean of air in which we live and do little harm.

If, however, coal is imperfectly burnt the hydrocarbons instead of burning to clear colourless gases decompose and send out smoke which consists mainly

Wipe out that smoke!

" Scientific methods of coal consumption would not only abate the nuisance and promote health and the amenity of life, but would be economical in industry. The emission of black smoke from chimneys serving boilers only is unnecessary and reprehensible."

The above is taken from a paper read before the Royal Sanitary Institute by Professor Wynne, M.B., D.P.H., Medical Officer of Sheffield, a full report appears in the current issue of *Cheap Steam*, published by Edward Bennis & Co. Ltd., a copy of which will be gladly sent on application.

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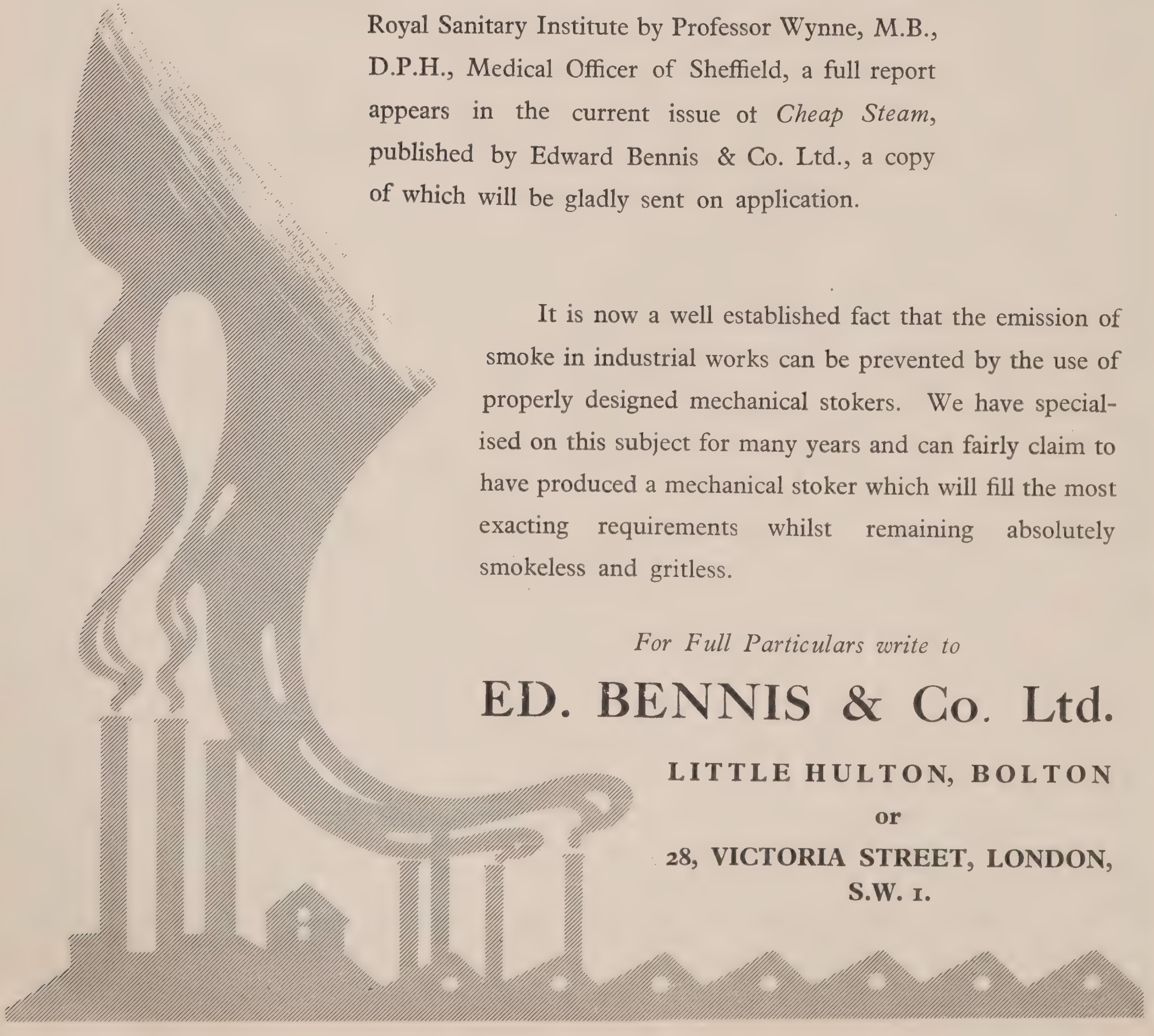


of finely divided carbon charged with tarry matter and sulphur acids. These latter cause intense irritation to the respiratory membranes.

The finely divided carbon has a tendency to attract moisture forming haze and fog which prevents the free diffusion of the gases. In naturally misty weather these carbon particles concentrate in the lower strata of the atmosphere with disastrous effect on the breathing apparatus.

When we consider that an adult breathes 5 or 6 times more air than all other food and drink consumed, it seems strange that so little care is taken to preserve its purity and such stringent precautions taken with food and water. That the most vital of the necessities of life should be the least taken care of.

Some may think that this is a small matter, but, for example, experiments have shown that over 20 thousand tons of solid matter is deposited from the air on the City of Manchester in a year—this contains tar equal to 75,000 gallons and sulphur acids equal to over a quarter of a million gallons. (Substitute local figures wherever possible).

The effect on the lungs is well shown in the accompanying pictures. The natural lung is of a rose pink colour, the townsman's lung is more grey, with blotches of sooty matter imbedded in the tissues.

This obstruction in the lungs prevents the proper passage of the air, the blood is less perfectly oxidized and more easily a prey to lurking bacteria which are seeking a home in which to work their fell designs. The blood cannot do its work properly. Catarrh, bronchitis, emphysema supervene followed by cardiac failure—too much work has been put on the heart and it stops.

This affects more especially the very young and the old. After foggy weather the death rate from respiratory diseases rises enormously. It is highly probable that the high infantile mortality in towns and especially the more congested parts is due to the filth in the atmosphere being too much for the delicate lungs of newly born children in conjunction with the effect of the loss of solar radiation due to the smoke cloud hanging over the towns.

The loss of solar radiation is equally important with the direct action on the lungs.

The loss of day light in our industrial districts is very serious. Experiment extending over 4 years shows that Manchester only receives about 55% of the light received in a country place 7 miles away in Cheshire, and in the congested areas this drops to under 40%. The invisible radiation which are even more important than the light rays are cut off in a much greater degree. The year through I doubt whether Manchester receives anything like 40% of what she might. In June last on a Saturday and Sunday—the Sunday was one of the brightest sunny days—the record of 25½° was observed in Cheshire to only 6½° at the Civic Buildings, Manchester.

This deprivation of solar radiation is responsible for :

1. Rickets.
2. Anaemia.
3. General debility.
4. Increased sensibility to bacterial infections.

It is becoming more and more realized that solar radiation is essential to life.

Within the last few years bio-chemical research has shown that however satisfactory in food value a diet is unless it contains, one may say traces, of certain bodies of at present unascertained composition, it will not support life. For instance, rats feed upon a diet thus wanting will develop a rachitic condition and will die. If, however, a diet containing these substances, or if they are exposed to the sunshine, or sunlight lamp for a short time each day they do not develop the rachitic condition or they are cured of it as the case may be.

The loss of sunlight due to the smoke cloud hanging over our towns causes, especially in their more congested parts, rickets among the children and has earned it the name of the "English disease" with our continental neighbours.

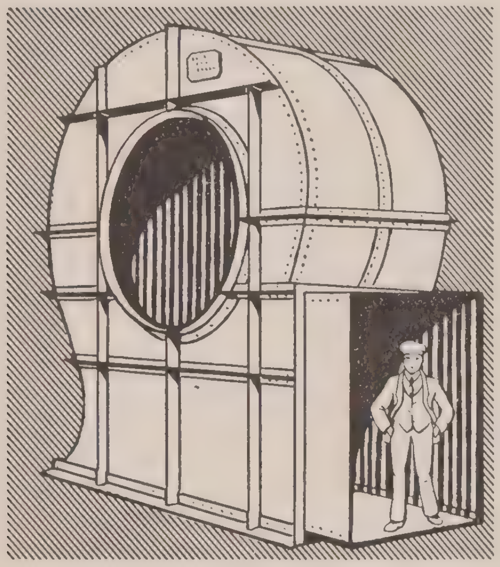
To look at it from another angle—it has been proved that surgical tuberculosis can be cured by judicious exposure to sunlight, without any recourse to the knife or to drugs. There have been many successful cases treated as Alton and Hayling Island in Hampshire and other places and at Leysin in Switzerland.

The solar radiations have also a marked effect in improving the health and are probably the best tonic one can have.

The ultra-violet rays are lethal to bacteria, *i.e*, bacteria die when exposed to them and they render the human system very less likely to be affected by bacterial infection *e.g.*, influenza, colds, pneumonia, etc.

The effect on vegetable life is even more marked than on the animal economy. In the congested areas of our cities plant life gradually dies out and even in the open spaces it is only by constant attention and yearly renewals that the hardiest plants will grow at all. Two examples within my own knowledge will suffice. The biennial foxglove blooms in profusion in Cheshire, 7 miles from Manchester, but if you desire foxgloves to bloom, say in Victoria Park, Manchester, you must get the young plants from the country in the spring. In Cheshire the plant will keep reproducing so as to become almost a nuisance. In Manchester if a seed germinates it will not survive the winter.

Firs will grow easily in Cheshire but none will flourish in Manchester.



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Nor account is taken for the extra labour entailed in this.

Sir Frank Baines, H.M. Board of Works estimates the increased cost of decorating and repairing due to smoke to be £120,000.

What is the cost to the nation of ill-health, one cannot estimate. The time lost alone by common colds, to say nothing of the loss of efficiency must be enormous.

The ugliness caused by the deposition of soot on the buildings is well exemplified in the condition of Manchester Town Hall. When built it was a handsome white building. I have known people who remembered it glistening in the sunlight. To-day its blackness has spoilt its beauty and a stranger might be excused if he thought it was some grim fortress prison.

Annual Conference, Leicester.

Atmospheric Pollution as Affecting Visibility

By M. G. BENNETT, M.Sc.

Meteorological Office Air Ministry, Kew Observatory, Richmond, Surrey, September, 1930.

Introduction.

Visibility is a very complicated phenomenon, and is affected by a large number of factors, meteorological and other. Not the least of these is smoke, and I propose to demonstrate to you in this paper, that this factor is often sufficiently important, even in country districts, to reduce visibility by appreciable amounts.

We will take it as a self-evident proposition that in an ideally clear atmosphere, the only limit to the distance at which an object would be visible, would be imposed by imperfections in the eye, and this limit would be very great, especially for large, well-defined objects such as skylines. The maximum distance of vision that has ever been recorded is somewhere about 400 miles, when, owing to an optical diffraction effect, an observer on one of the Swiss Alps was able to look round the curvature of the Earth, so to speak, and saw with the naked eye the English coast. This, I believe, is an authenticated observation.

Generally we can see only to very much smaller distances than this, and the limit, in practice, is set chiefly by the amount of matter suspended in the atmosphere. Amongst the lesser factors may be mentioned illumination, and "shimmer." The obscuring matter may consist of drops of water or liquid (either finely divided as in fog, mist, and cloud, or coarse as in rain), solid particles such as dust, soot, snow, etc., or combinations of these.

The mechanism of obscuration.

Let us consider in what manner these different types of matter affect visibility. For an object to be visible, it must not only be illuminated (or be self-luminous, as a light), but there must be some contrast between itself and its background. The action of the suspended matter is to reduce the brightness or contrast until the object is obscured. This may happen in three ways.

(1) Screening. Some of the light will be cut off, so that the object is darkened. The magnitude of this effect will be mainly a matter of the concentration of black particles in the atmosphere.

(2) Diffusion. The matter diffuses the light coming from the object, so that its boundary appears no longer so sharply defined.

(3) Glare. The sun's light, falling on the matter, causes it to shine, and this tends to swamp out the object behind it.

The last two effects are chiefly controlled by the concentration of liquid drops and grey particles in the atmosphere.

The origin and production of obscuring matter in the atmosphere.

I have spoken in a general way of the main types of suspended material responsible for obscuration. Let us now consider their origin and method of production in more detail.

A considerable amount of information on the origin of the solid impurities of the atmosphere has already been placed before this Society, and I do not propose to enlarge upon this. Rather, let us consider the liquid drops.

Two conditions are necessary for the production of liquid drops in the air. Firstly, a sufficient concentration of the vapour of the material (generally water in the present case) must be present. Secondly, it has been demonstrated by Aitken (1) and others that nuclei are necessary, upon which to start the process of condensation. Once started, the process will continue until equilibrium is set up between the various physical forces of vapour pressure, etc.

(Liquid drops in the form of spray may be produced near waterfalls and the coast, but such cases are too few to be considered now).

There remains a lot to be learnt about the details of the mechanism of condensation, but certain empirical information, of application to the present problem, may be quoted.

A concentration of vapour, sufficient to produce condensation on the particular nuclei present at any place or time, is generally produced by cooling of the mass of air concerned. A variety of processes, such as contact of a warm humid atmosphere with a cold earth, or mixing of a warm humid mass of air with a cold mass, may produce this result. It is not necessary at the moment to go into these processes in detail.

With regard to the nuclei, it has been shown by Wigand (2) and Boylan (3) that not all the dust in the atmosphere can act as centres of condensation. Probably oily particles cannot, for instance. Of those particles which can so act, some require a vapour pressure of 100% humidity, and some less than this, before they will function. Those that require less than 100% are spoken of as " hygroscopic." Although, as I have pointed out, much remains to be learnt on this subject, a rough classification may be attempted of the nuclei likely to be found in our atmosphere.

The nuclei which require 100% humidity, include certain types of ordinary dust ; but road dust and many other sorts probably never act as nuclei at all. Amongst hygroscopic nuclei must be placed salt particles, molecules of sulphur dioxide, and, in general, any substance which has great chemical affinity for the vapour.

It often happens that the same agency will produce at once, both nuclear and non-nuclear dust. Observation shows that there is generally a proportion of each in most places. Add to this the fact that the optical phenomena are in themselves very complicated, and you will see that the resultant visibility on any occasion is a highly involved affair. I hope, however, that in the examples which I am about to set before you, you will be able to discern the effect of smoke.

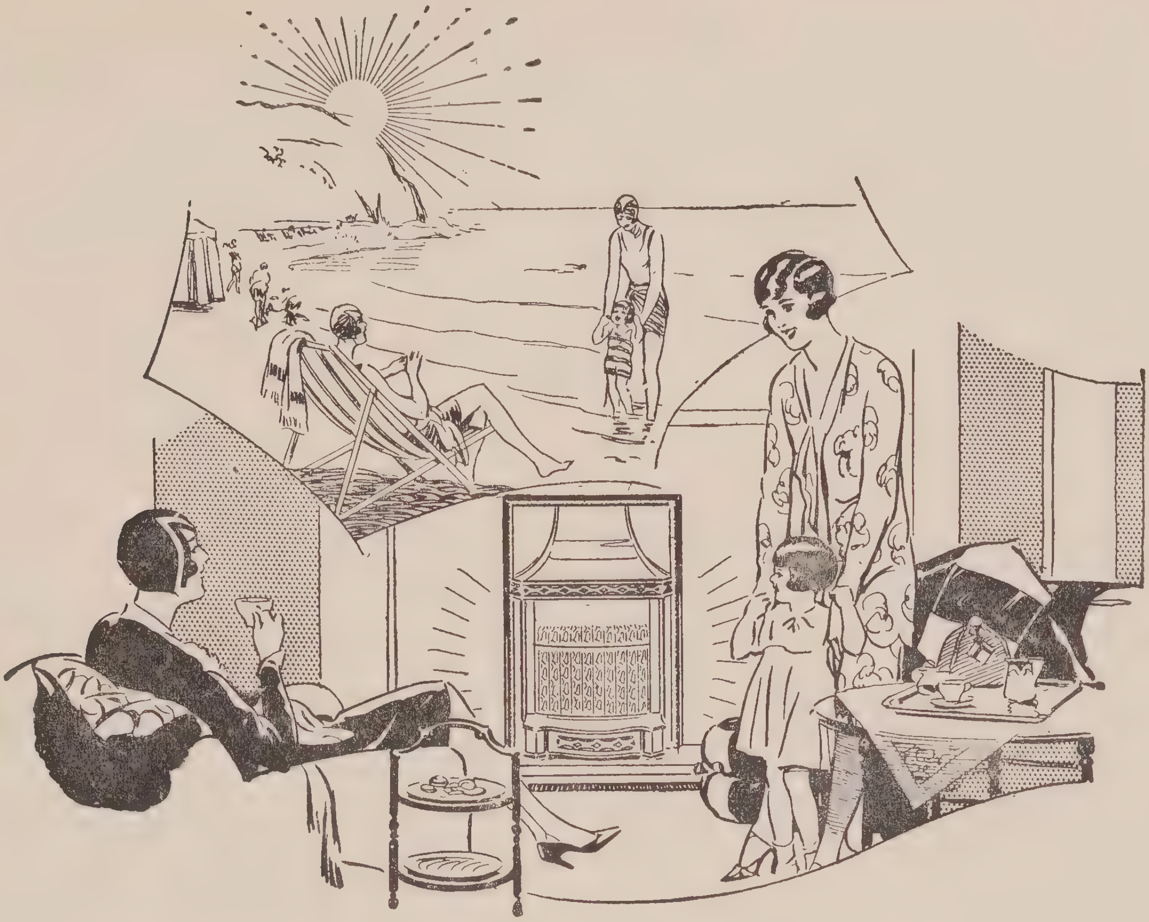
Observations on the relation between pollution and Visibility.

Towards the end of last century, Dr. John Aitken (4) took numerous observations of the visibility, and the number of condensation nuclei, in many parts of Europe. He found that the total number of nuclei between the observer and an object, necessary to obscure an object, depends only on the humidity ; that is, at a given humidity, the distance of vision is inversely proportional to the number of nuclei per unit volume. He gives a table showing the number of nuclei " to produce complete haze " at various humidities. This rule is much too simple to be anything more than a rough generalisation. Further, it is not quite certain what exactly his nuclei counter did count. Nevertheless, remembering that nuclear and non-nuclear dust bear a fairly close relationship one to another, the result is very significant.

Further work of Aitken's was undertaken to demonstrate the " hazing effect " (as he called it) of pollution from the industrial areas of the country. Observations of humidity, wind direction, and visibility were carried out at Falkirk, which is about midway between Glasgow and Edinburgh, but a bit to the North of these towns. Stretching away in a north-westerly direction from this site is a large area of country innocent of smoke production—the population is less than 50 to the square mile. On all other sides Falkirk is surrounded by a dense population. If it is true that humidity and dust are the main controlling factors in visibility, we should expect that, at comparable humidities, winds from the northwest would bring much more transparent air than winds from any other quarter. This is what is found. The curves drawn on this map show the limiting distance of vision, in any direction from Falkirk, for various amounts of depression of the wet bulb (the greater the depression, the dryer the air). With a depression of 8 degrees, a N.W. wind gives a visibility of 250 miles, while a S.W. wind gives only about 20 miles. (No actual object was seen at 250 miles, but this figure was calculated from the clearness with which a nearer object could be seen).

Very similar phenomena occur at Kew Observatory. Winds from an Easterly direction from London will reduce the visibility at this station to much below its average value.

For some years I was working in the Wills Physics Laboratory at the University of Bristol, in a room in the tower which commanded a view of not less than 15 miles in any direction. Right at my feet, so to speak, was the City, supplying pollution. All the effects that I who had seen that view as often as I have would need have spoken about here were clearly visible. Unfortunately I have no systematic data to show you, but anyone



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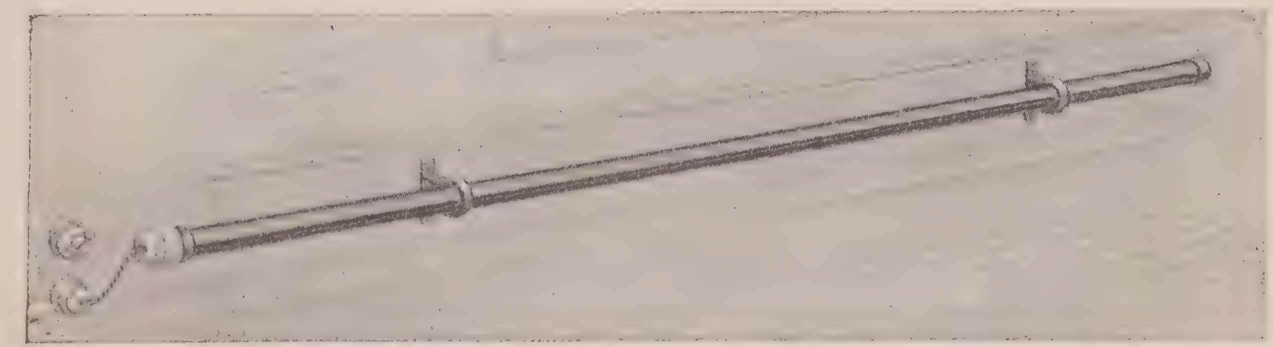

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no numerical data to convince him of the harmful effect of pollution on visibility. Quite often one would look down on a broad dark belt of smoke starting from the City and stretching down as far as one could see. In other directions, and over the top of this belt, one could see for, say, 20 miles ; but into the belt one could see nothing. How often I remember saying to visitors, "The Mendips are over there on the other side of the City, but I'm afraid you cannot see them to-day for the smoke." And often, at the same time, the Welsh hills, 5 miles further away, but in the other direction, would be clearly visible.

As an outstanding case of smoke being carried to a great distance, in sufficient quantities to affect visibility, I would quote Dines and Mulholland (6) who observed the adverse effect of pollution from the English industrial centres, on the visibility at Valentia on the South West coast of Ireland, 350 miles away.

That gaseous nuclei, such as sulphur dioxide, do exist in quite large concentrations in the air in and around large cities, has been adequately proved from observations with the "Deposit Gauge;" and there is little doubt that, by inducing condensation, they are powerful agents in reducing visibility. As the contents of these gauges are only examined at long intervals, however, it is difficult to obtain a quantitative correlation of the observations with visibility.

Overhead Fog.

One visible phenomenon due to smoke, which is of great practical importance, is that of overhead fog. The atmosphere at the ground is fairly clear, but the sun's light is practically completely cut off by a layer of sooty fog overhead. The general opinion is that the frequency of this phenomenon is increasing, but I have been unable to obtain statistics on this point. Owing to improvements in the cleaning, draining, and heating of London, it is probable that this type of fog is gradually being substituted for the old "London Particular" type which extended right down to the ground. The point I wish to emphasise at the moment, is that if this overhead fog were but clean, it would merely resemble a rather dense layer of stratus cloud, and would not obstruct the sun's rays sufficiently to upset the life going on underneath it. This is proved by the fact that such darkness never occurs in country districts.

Conclusion.

The evidence that I have brought before you, is, I hope, sufficient to convince you that smoke, and the nuclei of condensation with which it is so often associated, is a very real agent in producing bad visibility, not only near the sources of pollution, but in remote country districts.

References.

(1) Aitken. Trans. R.S.E., 30. 1880-81.
(2) Wigand. Met, Zeit., 30. Jan. 1913.
(3) Boylan. R. Irish Acad., Proc., 37. Sept. 1926.
(4) Aitken. Trans, R.S.E., 37. 1894.
(5) Aitken. Proc. R.S.E., 20. 1892-93.
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Annual Conference, Leicester.

Visibility as Affecting Aviation.

BY F. ENTWISTLE, B.SC.
Superintendent, Aviation Services Division, Meteorological Office, Air Ministry.

Introduction.

Bad visibility affects all modes of travel and transport, whether on land or sea or in the air. Other meteorological factors may be of importance in particular cases. For example a severe gale may inconvenience a large liner and actually jeopardise a small fishing craft in the open sea. A heavy fall of snow may dislocate temporarily rail and road services. Again strong head winds may impede the progress of an aircraft, and, in an extreme case, cause a forced descent short of its destination owing to its fuel having become expended. Bad visibility, however, is the common enemy of all. But, whereas, in the case of travel on land and sea, a thick fog is required before serious inconvenience is felt, the pilot of an aircraft, travelling perhaps at a speed of 100 miles an hour or more, is affected by conditions of visibility which are relatively unimportant to surface transport. Moreover a fog may not only inconvenience, but may be a positive source of danger to an aircraft in flight, particularly if it envelops the aerodrome when a landing has to be made. It may be noted also, in passing, that visibility conditions in the upper air may be quite different from those near the ground, even though they may be produced by phenomena having their origin at the surface. In the present paper I propose to confine my attention to phenomena of this kind, that is surface phenomena which may produce bad visibility near the ground or in the upper air. Factors such as low cloud, heavy rain and snow fall within a different category at least from a meteorological standpoint.

Meteorological conditions for the formation of fog.

Before proceeding to that aspect of the subject which is of particular interest to this Society, I should like to refer briefly to the meteorological conditions which are associated with the formation of fog. To understand the processes involved, and also certain references

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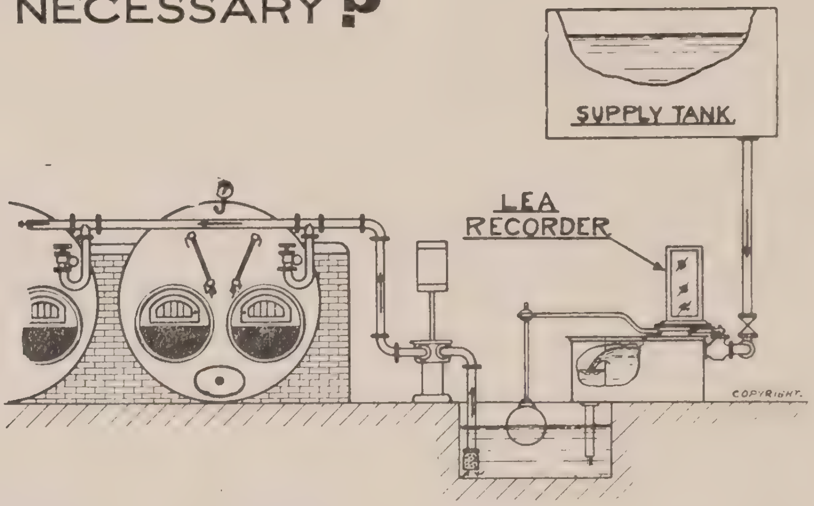

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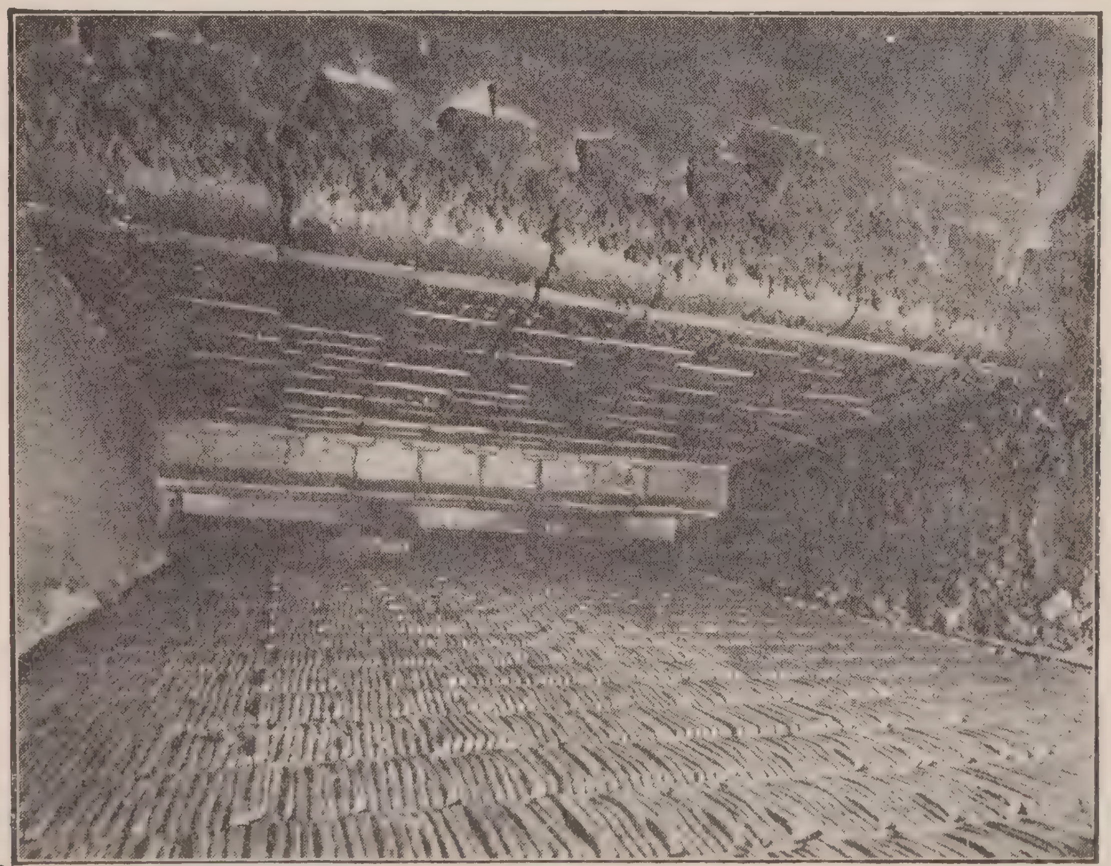

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which I shall make later, it is desirable to consider first the way in which air temperature varies with increasing height above the surface of the earth. On the average the temperature decreases at the rate of 3°F. for every 1000 feet of ascent but the actual rate of decrease, or " lapse rate." on a particular day may be very different from the average value, particularly in the lower layers near the ground. In certain conditions the temperature may actually increase with increasing height, forming an " inversion."

Now let us consider a particular mass of air near the earth's surface which, owing perhaps to intensive heating of the ground by the sun's rays, becomes warmer than the general body of air surrounding it. On being warmed this mass of air will expand and will become lighter than the surrounding air. It will then tend to rise, like a cork in water. But in rising it expands further owing to the fact that the pressure of the atmosphere diminishes with increasing height. The process of expansion causes the air to lose heat, the rate of fall of temperature of rising air which is not saturated being about 5½°F. for every 1000 feet. If, then, the general temperature lapse rate in the surrounding air is greater than 5½°F. per 1000 feet the mass of air will go on rising for at any height it will be warmer, and therefore lighter than its environment. When this occurs the atmosphere is said to be *unstable*. If, on the other hand, the general temperature lapse rate is less than 5½°F. per 1000 feet, the mass of air will tend to fall. back for it will be colder, and therefore heavier than its environment. The atmosphere is then said to be *stable*. The smaller the lapse rate the more stable will be the air, an inversion being a very stable condition.

Mr. Bennet has referred to the condensation of water vapour in the air on nuclei. Condensation is brought about by the cooling of the air below its dew point. The most obvious way in which the air near the ground can become cooler is through contact with a colder surface. When such a condition obtains an " inversion " is formed near the ground, and, provided that the humidity of the air is sufficiently high condensation occurs in the layer of the inversion by the turbulent mixing and consequent cooling of the air within it. A layer of fog is thus formed, the height of the fog being determined by the height to which the inversion extends. The thickness of a fog is usually less than 1000 feet and frequently less than 500 feet. An important condition in regard to the formation of a fog is that the wind should be light, thus allowing the air in contact with the ground to become effectively cooled.

Example of fog affecting a wide area.

The conditions requisite for the formation of a fog may be brought about in several different ways. One of the most common types occurs during the calm, clear nights associated with anticyclones in autumn and winter. The ground then becomes cooled by radiation to the sky, giving rise to a shallow temperature inversion and the formation of a layer of fog as described.

Prevalence of Fog at various Aerodromes.

Although the meteorological circumstances favourable for the formation of fog may, and frequently do, affect a wide area, the prevalence of fog in any locality depends to a considerable extent upon local conditions. This will be evident from the following table, also taken from an earlier paper (1) which shows the prevalence of fog and mist at various air stations, the positions of the latter being shown on the map in figure 3.

Prevalence of Fog and Mist at various stations.

Table showing percentage frequencies of visibilities less than 500 m. and 2,000 m. respectively (based on observations made between the years 1920 and 1925).

	STATION	Number of days per 100 on which there occurred	
		Visibilities less than 500 yards	Visibilities less than 2,000 yards
I	Cattewater	0.5	1.7
	Holyhead	0.4	2.0
	Leuchars	0.9	2.9
	Calshot	1.1	3.8
II	Andover	2.2	4.8
	Felixtowe	1.8	5.3
	Grain	2.2	5.6
	Cranwell	2.9	6.0
III	Lympne	3.1	7.6
IV	Biggin Hill	2.8	9.1
	Castle Bromwich	1.3	9.3
	Croyden	2.4	10.2
V	Farnborough	4.1	11.3
VI	Sealand	1.6	14.8
	Renfrew	2.6	14.8
VII	Manchester	7.6	43.8

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(1) F. Entwistle, "Meteorology in relation to the selection of aerodrome sites." III Congres International de Navigation Aeriene. Brussels October 1925.

Smoke and Disease

Smoke is perhaps the gravest danger to our national health.

Statistics show that about fifty per cent. of the time lost in workshops and offices in this country is caused by respiratory diseases due to the pollution of the atmosphere by smoke.

More than half the three-year-olds of this country have rickets, because they are robbed of sunlight by the smoke pall.

The amount of sunlight has been found, by readings taken from various parts of England, to be in inverse proportion to the degree of air pollution.

About seven-eighths of the sun's power is shut off by smoke from the centre of London, and eighty tons of poisonous soot are emitted in the capital every hour.

The remedy lies in the burning of the smokeless fuels, gas and gas coke. The atmosphere is not polluted in the slightest degree either during their manufacture or their actual combustion.

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One of the most conspicuous features of this table is that the frequency of bad visibility, particularly between 500 and 2,000 yards, increases in a very marked way in the case of stations situated near large cities and industrial centres which are the main sources of atmospheric pollution. The stations in the first three groups are remote from such sources. When we come to group IV, however, we find three stations liable to be affected by smoke pollution, Croyden, and to a less extent, Biggin Hill being affected in favourable conditions by smoke drifting over the aerodromes from London and Castle Bromwich being affected owing to its proximity to Birmingham. The relatively large number of fogs at Farnborough is due primarily to special local conditions but even at this station in favourable circumstances the effect of London smoke is felt. Sealand and Renfrew in group VI are very similarly situated with regard to industrial areas, while Manchester is an outstanding example of the effect of industrial smoke on visibility. The figures for that station (Alexandra Park Aerodrome) indicate that visibility is below 2,000 yards on approximately one day out of two.

Meteorological Conditions for Formation of Smoke Fog.

The extent to which the smoke from an industrial area affects the visibility in the neighbourhood depends to some extent on meteorological conditions, as well as on the distance from the source of the pollution. The most favourable conditions are identical with those in which ordinary fogs form, viz.: a temperature inversion near the ground and a light wind. The former prevents the smoke particles from being carried away vertically while a light wind prevents them from being carried away too quickly horizontally. With a large temperature lapse rate, the smoke particles are carried upwards by convection and visibility near the ground is not affected to so great an extent. When an industrial area, owing to its topography and geographical position, is subject to ordinary fogs, it will be evident that when the latter occur the effect on visibility is intensified, owing both to the cumulative effect of the smoke and the condensation fog and to the fact that Condensation is facilitated by the additional nucleii present. The high frequency of fog in the Manchester area may be attributed to this cause.

Effect of Smoke on visibility at Aerodromes.

The carrying of smoke by the wind is well illustrated by comparing the visibilities at Croyden and Stag Lane (Edgware) aerodromes with light winds from different sectors. The London smoke is carried over the aerodrome at Croyden by winds from between N.W. and N.E. while Stag Lane is affected by winds from between E. and S.S.W. The greater prevalence of bad visibilities in the case of the aerodrome on the leeward side of London is clearly indicated. It should be noted that the visibility has been plotted on a logarithmic scale for convenience.

The foregoing considerations raise an important problem in regard to the siting of municipal aerodromes, particularly in industrial areas. Other things being equal, such an aerodrome should be situated, as regards the prevailing wind, on the windward side of the town. In this country the normal situation for a municipal aerodrome would thus be to the west or south-west of the town. This problem has to be considered in conjunction with general meteorological conditions and selecting aerodrome sites it is customary to make a preliminary survey of alternative sites particularly from the point of view of fog prevalence, including the possible effect of industrial and domestic smoke. Whatever precautions are taken, however, there will always be occasions as long as the smoke nuisance persists, when visibility over the aerodrome is affected, since the wind never blows consistently from one direction.

Effect of smoke on visibility at places remote from source of pollution.

Mr. Bennett has already referred to the fact that smoke can be carried a considerable distance in sufficient quantities to affect visibility. Details of a particular case may be of interest. On February 21st I travelled from Lincolnshire to Catterick in Yorkshire. In Lincolnshire and along the entire route the weather was fine and bright and visibility, though not exceptionally good, was well over 3 miles. There was, in fact, nothing in the weather to stop flying. At Catterick, however, visibility was not more than 500 yards in any direction. There was a thick haze which was sufficient to stop all flying at the aerodrome there. This was due entirely to smoke from the Leeds area, fifty miles away, which was carried northwards by the light southerly wind.

It was pointed out earlier that a light wind and an inversion of temperature near the ground are favourable for the concentration of smoke particles in a shallow layer with consequent deterioration in visibility to leeward source of pollution. In the case cited, observations of temperature in the upper air taken in eastern England showed that there was an inversion between 3,000 and 5,000 feet. This ensured that the smoke was confined to relatively low levels and would account for the thick haze at Catterick.

In general, as the temperature lapse rate increases the smoke from industrial centres and large towns is carried down wind, extending in a gradually widening belt. With the prevailing south-west to west wind, pilots flying between Scotland and the south of England frequently encounter smoke haze from the "Black Country" when over southern Yorkshire. Similarly on the London-Continent civil air route, pilots have on occasions met appreciable haze due to London smoke, over the Channel some miles from the Kent coast.

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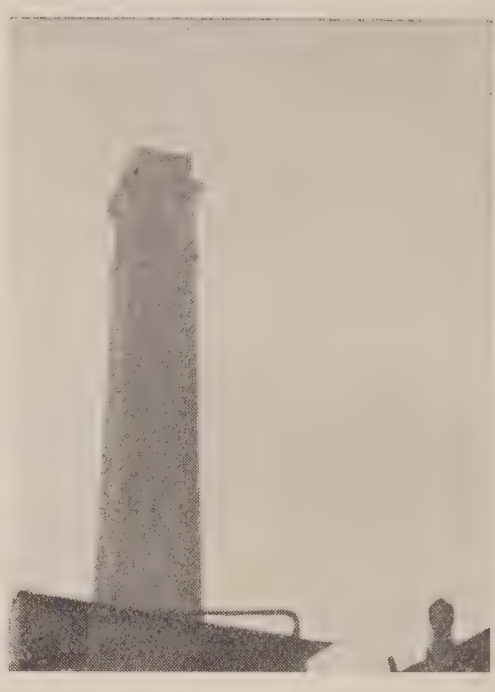

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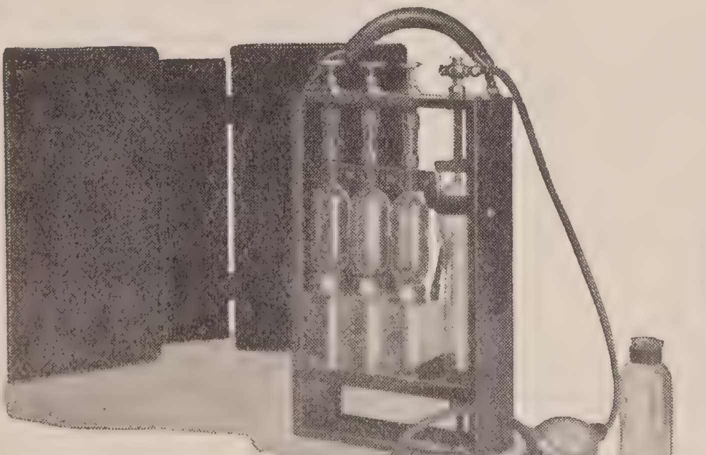

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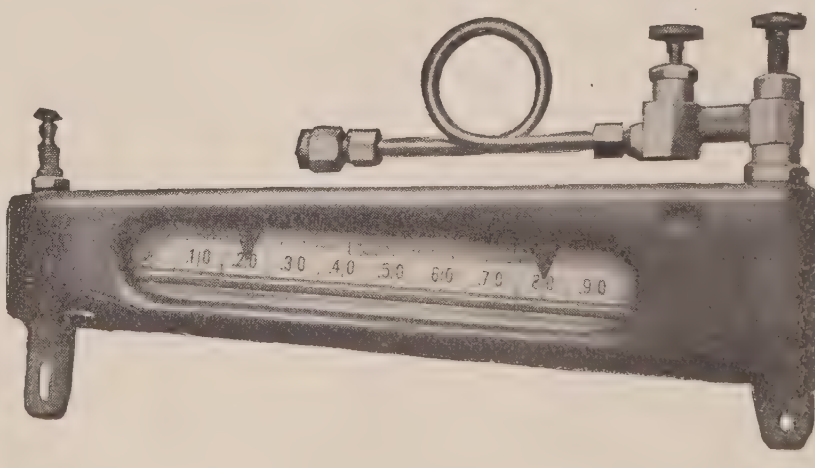

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Under favourable conditions, when the temperature lapse rate is relatively high, thick smoke haze from the Midlands, reinforced by smoke from London is carried by winds from the north-west over south-east England and even over northern France. Similarly with easterly winds, smoke haze from the industrial districts of Germany is carried over Southern England. In these conditions the smoke haze penetrates upwards owing to the relatively high temperature lapse rate and visibility in the air may be worse than the horizontal visibility on the ground. If the humidity in the upper air is high, visibility is rendered much worse owing to the upward penetration of smoke than is the case when the air is dry.

Conclusion.

Sufficient has been said to indicate that the bad visibility produced by smoke has a considerable effect on flying operations. It is no exaggeration to say that if all the smoke were removed from over this country, many more days of flying per year would be possible.

Annual Conference, Leicester.

Fuel Research and Smoke Abatement

BY MARGARET FISHENDEN, D.SC., F.INST.P.

(Fuel Research Division, Dept. of Scientific and Industrial Research).

Great Britain is mainly dependent upon coal for fuel, and also, since water power is not abundant, for electricity generation. Hence there are, broadly speaking, two ways of avoiding smoke pollution :—

(1) By observing such scientific principles in the burning of raw coal that smoke is not emitted, and

(2) By discontinuing the burning of coal in its raw state, and instead using it for the manufacture of various forms of coke and gas or for the generation of electricity.

Progress has been made along both these lines. The first entails the necessity for some simple means of measuring the smoke emission from chimneys. Various methods have from time to time been suggested. These have been based mainly either upon determining the optical density of smoke by comparing its ability to transmit light from the sky with that of smoked glasses viewed in the same direction and against the same background as, for instance, in Dr. Owen's carboscope ; or by comparing the colour of smoke with some standard chart of shades viewed by reflected light as in the Ringelmann method. These methods were discussed by Eng. Capt. J. Fraser Shaw, R.N. (Rtd.), Chief Engineer, Fuel Research Station, East Greenwich, S.E.10., and T. F. Hurley of the same establishment, in a recent article on " Methods and Standards of Smoke Measurement " in the 1930 Fuel Economy Review. It was pointed out that they are both open to objection since any instrument designed to measure smoke density by optical means should take account of, or make due allowance for, the size of the chimney, the effect of wind, the colour of the smoke, and the colour and intensity of the background. Further, while the light from a fine smoke is mainly transmitted, that from a dense smoke is mainly reflected. The colour of the smoke is also affected by the size of the individual particles of which it is composed and this varies with the boiler load, the completeness of combustion, etc. A modified optical method has been developed at the Fuel Research Station in which parallel black lines similar to those used on the Ringelmann charts, but finer and closer together, are produced photographically on a transparent background. This enables the screens to be used with the same background as the smoke and to be reduced in size and used closer to the observer. Tests carried out on dull days and in bright sunshine indicated that correct readings are obtained under all atmospheric conditions provided the sun is not directly *behind* the observer ; and it was concluded that when used under spicified conditions, *i.e.*, 10 feet from the observer, 200 yards from the smoke, and with the sun not immediately behind the observer, the line screens formed a reliable standard of comparison, and that the same smoke would always correspond to the same screen irrespective of atmospheric conditions.

The most satisfactory method of determining smoke emission would probably be to determine directly the proportion by weight of suspended matter in the chimney gases. Such a method would not be feasible in practice, but some interesting tests have recently been carried out along these lines at the Fuel Research Station on a hand-fired Lancashire boiler and a small stokerfired Babcock boiler. The concentration of the smoke was measured by both gravimetric and optical methods and the relation between the weight of suspended matter in the flue gas and the composition of the suspended matter, the composition of the flue gas, the optical density of the smoke and the conditions of combustion, were thus determined.

The weight of suspended matter in the smoke was found to be approximately proportional to its absorbing power as measured in the chimney by comparison

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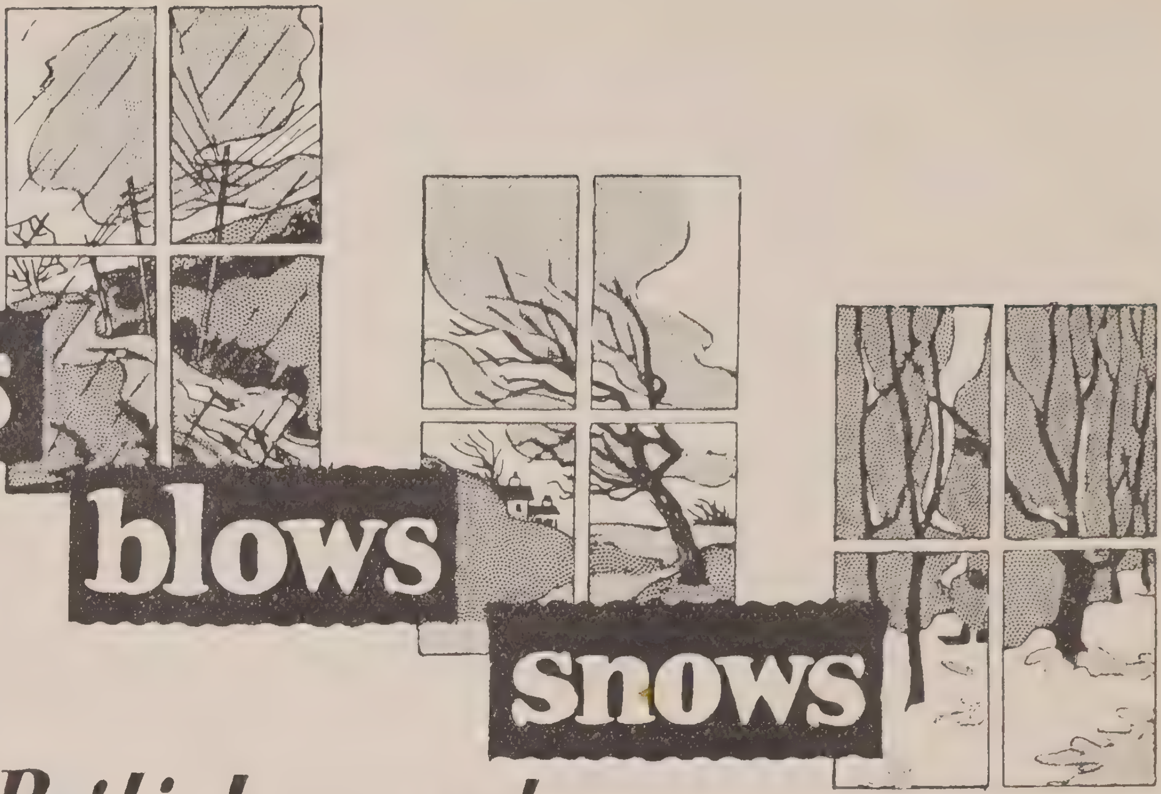

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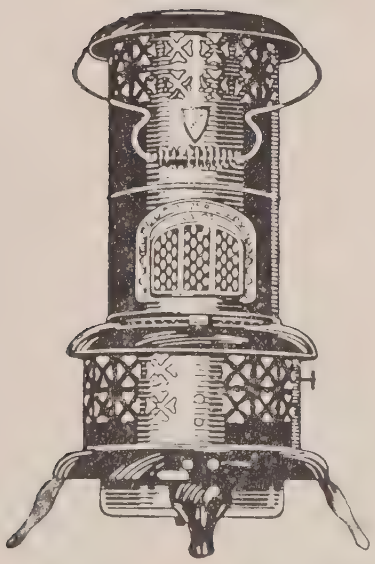

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with that of calibrated smoked glass, the source of light being a parallel beam from an arc lamp. When compared with the ash, carbon and tar content of the smoke separately, it was found that a high intensity of smoke corresponded with a high proportion of carbon and tar, but a low proportion of ash.

The thermal losses in unburned carbon monoxide, etc., were found to increase with the observed smoke intensity, and in the worst cases totalled as much as 10% of the heat supplied in the fuel. The results obtained, however, of course depend upon the conditions of combustion, and as might be expected, the optical density of the smoke for a given weight of suspended matter per cu. ft. varied with the load, the same optical density corresponding to a greater smoke concentration at light loads than at full loads owing to changes in the characteristics of the particles forming the smoke.

Improved furnace design and the adoption of continuous mechanical stoking have made it possible to burn even bituminous coals almost without smoke in up-to-date steam boilers, although in smaller hand-fired boiler furnaces, which are still numerous, the position is less satisfactory. This is mainly because the periodic opening of the firing door and the careless introduction of large quantities of cold fuel cause temporary chilling of the process of combustion and uneven resistance in the fire body. Surprisingly good results, however, can be obtained if a uniform depth of fuel is maintained by careful and regular stoking at short intervals.

As a result of the increasing use of bituminous coal in the United States and Canada, much research has lately been directed towards obtaining maximum efficiencies and minimum smoke production in both large and small coal fired boiler installations. It is claimed that with suitable methods of stoking little smoke is produced. In the interests of smoke abatement the possibilities of coke as a boiler fuel have also been investigated by the United States Bureau of Mines, the Canadian Department of Mines, the Comité Central des Cokes de France, as well as by various commercial bodies, and it has been shown that under suitable conditions both gas coke and metallurgical coke give efficiencies at least equal to those obtainable from coal; but it must be remembered that in boilers designed for use with coal the reduction in capacity entailed by the change over to so bulky a fuel as coke may cause trouble. Although black smoke is not emitted, moreover, the thermal loss due to unburnt carbon monoxide may be very high for coke small enough to pass through, say 1 inch screen. In tests made by the Comite Central des Cokes de France, 45 mm. coke gave 83 per cent. efficiency in comparison with only 77 per cent. for 20/35 mm. size, the reduction being due to increased formation of carbon monoxide. Similar results were obtained at the Stockholm gasworks, 65/100 mm. and 15/22 mm. coke giving in parallel tests efficiencies of 80 per cent, and 62 per cent. respectively, the loss in unburned products of combustion rising from less than 3 per cent. with the larger fuel to 21 per cent. with the smaller fuel. Practically no difference was found between gas and metallurgical coke. Again, Aberle found efficiencies and carbon monoxide losses varying from 70 per cent. to 80 per cent., and nil for 60/80 mm. coke to only 50 per cent. to 60 per cent, and 10 per cent, for 20/40mm. coke. Kreisinger has suggested that when burning coke part of the hot surface of the fuel bed should always be kept uncovered in order to ignite any unburnt carbon monoxide.

Oil has many advantages over solid fuels for boiler purposes, since more rapid and finer regulation can be effected automatically, the handling of ashes and coal is eliminated and fuel storage reduced to a minimum. It is, however, higher in running cost for continuous work, though its flexibility in use may often go a long way towards counterbalancing the higher fuel costs.

For domestic purposes the main alternative to raw coal gas, are coke or other carbonised fuel, and electricity. The gas industry has striven systematically towards improved methods of manufacture, distribution and use, and in consequence the yield of gas per ton of coal carbonised has steadily increased, the price per therm has fallen, and the efficiency of gas appliances has improved. On the other hand, every effort is being made to establish a more general and cheaper supply of electricity in Great Britain. The Central Electricity Board, under powers conferred by the 1926 (Electricity) Supply Act, and working in co-operation with the established electricity supply industry, is gradually constructing a network of lines connecting the main generating stations and bringing a wider area under supply from efficient plant. At the same time many small out-of-date plants are being shut down. By the development of such a national scheme of transmission it is hoped to decrease substantially the average price of electricity production.

Notwithstanding these advances, the total domestic consumption of coal remains steady, although the consumption per head is slowly decreasing. It is generally admitted that for inclusive household purposes either gas or electricity, or any combination of the two, would compare unfavourably with coal on the basis of running costs, and that to assist a rapid improvement in the smoke nuisance some cheap solid smokeless fuel is called for. Hence the attention paid during recent years to the possibilities of the low temperature carbonisation of coal.

The products of low temperature carbonisation vary widely according to the manner of carbonisation, but in most cases the primary aim is either to produce an improved smokeless fuel or to deprive the coal of the greatest possible quantity of tar and spirit before using it for ordinary furnace purposes. In Great Britain the production of a smokeless free-burning solid fuel for use in domestic grates, and in the smaller industrial plant is the more important; but unfortunately the externally heated retorts, which are most suitable for this purpose, are relatively expensive to erect and work, and, according to estimates given by Dr. C. H. Lander in a paper on "The Economics and Commercial Development of Low Temperature Carbonisation in Great Britain" read before the 1930 World Power Conference in Berlin, are scarcely likely to pay unless the coke can be sold at a sufficiently high price to cover the cost of the coal treated. Since only 14 cwt or 15 cwt. of coke is produced per ton of coal, this means that the price of the coke would have to be 30 or 40 per cent. above that of the coal.

The demand for low temperature coke at a price about equal to that of the best household coal still exceeds the supply, but comparatively little is yet available, and there is still doubt whether it can be produced economically on a scale at all commensurate with the present national requirements even at this price. Further, if any considerable proportion of the 40 million tons of raw coal now used for household purposes were to be replaced by the product of low temperature carbonisation, it might be expected that the price of coal suitable for treatment would rise, while the price of domestic coal would fall. From the many estimates that have been made it seems probable that the damage directly due to smoke from domestic fires averages at least 10/- per ton of coal burned, while if the coke from low temperature carbonisation could command 10/- a ton more than household coal, some of the processes already developed could probably be worked at a satisfactory profit.

We can only hope for the best in regard to low temperature coke production, but in the meantime where raw coal is used it should be burned with as little smoke as possible. The substitution of gas coke for coal should also be encouraged. Except for the difficulty of ignition, good quality gas coke is an excellent domestic fuel for most purposes; it burns well in suitable designed open grates and in kitcheners usually heating the water better, and the oven less well, that coal.

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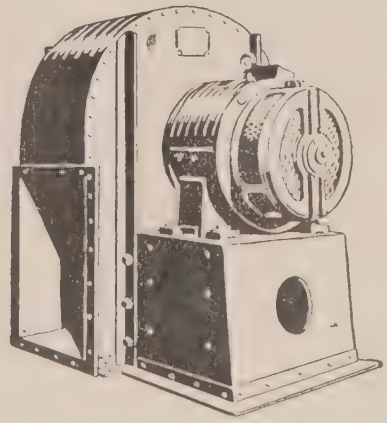

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